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ABSTRACT

Task Force 2, created by concerned voluntary and government agencies, outlines a program and resources to be developed to provide for the needs of children with minimal brain dysfunction (MBD), or learning disabilities. Task Force 1 reported on terminology and identification and Task Force 3 will deal with research in MBD, in other phases of the project. Included are the reports of the two subcommittees of the task force, one dealing with educational and the other with medical aspects of the problem. The report of the Educational Services Committee describes the present status of educational programs and legislation by surveying and evaluating the four following areas: educational assessment and evaluation procedures, classroom management methods, professional programs in teacher preparation, and educational legislation. The report of the Committee on Medical and Health-Related Services identifies the essential features of health services required by children with MBD. Evaluative procedures so identified include medical, neurological, electroencephic, psychologic, communicative, and psychiatric evaluation. Health-related and other services needed for comprehensive management of the child following evaluation are specified. Appended information focuses upon the neurological evaluation and psychodiagnostics in patients with suspected MBD. (KW)

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Minimal Brain Dysfunction in Children

Educational, Medical and Health Related Services
Phase Two of a Three-Phase Project

EC 032 166E

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Minimal Brain Dysfunction National Project on Learning Disabilities in Children

Phase Two

Educational, Medical and Health-Related Services

A Collaborative Project Co-sponsored by:

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The Easter Seal Research Foundation, National Easter Seal Society for Crippled Children and Adults, Inc., Chicago, Illinois.

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Foreword

No concern has higher priority in the national interest than does that of providing for every child the fullest opportunity for physical and intellectual development. Yet for one group of children, those now being spoken of as suffering from minimal brain dysfunction, or learning disabilities, the special resources required to permit the effective exploitation of latent abilities appear to be lacking in our society.

To attack this problem, concerned voluntary and government agencies have created a series of task forces to aid in establishing a blueprint for action. The report of Task Force I entitled "Minimal Brain Dysfunction, Terminology and Identification" was published in 1966. (Ref. Public Health Service Publication No. 1415.)

The present publication, the report of Task Force II, outlines the program and resources which will have to be developed to provide for the needs of these children. It is the report of two subcommittees—one dealing with the educational and the other with the medical aspects of the problem. The report of Task Force III which deals with research in minimal brain dysfunction is in press.

The term minimal brain dysfunction is an overall diagnostic term which highlights the fact that certain children, while not grossly impaired, exhibit limited deviations of intellect and behavior of such a nature as still to require special resources for their management and education. However the existence of an underlying brain dysfunction is in most instances implied rather than proven. For this reason there are many—especially those involved in the education of children who prefer to highlight the major problem and to use the term Learning Disabilities.

Recent years have seen a great increase in general interest and knowledge of this problem on the part of the many and diverse disciplines which can contribute to its solution. Increased research efforts have added much to our knowledge of methods for diagnosis and remediation, and to the methods for the recognition of the individual differences which may underlie the observed deviations of learning and behavior.

To date this knowledge has seen limited application. Only a small percentage of the affected children are at present receiving adequate services. It is the purpose of this task force report to outline the services which must be developed within any community to assure that each child has the opportunity to develop to his fullest potential.

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DEDICATION

This work is dedicated to the memory of Richmond S. Paine, who contributed so much to the study and recognition of dysfunctions of the central nervous system.

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PART I

Minimal Brain Dysfunction—National Project on Learning Disabilities in Children

Report of Educational Services Committee

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Preface

The important responsibility of Task Force II, as the committee viewed the task, was to describe as concisely as possible the present status of programs and legislation contributing to the education of the child with learning disabilities. The committee saw four somewhat definable areas as major sources of descriptive information: (1) Evaluation and assessment, (2) classroom management, (3) professional preparation, and (4) educational legislation. As the members began to investigate each of these areas, many facts useful to further refinements in the field became evident.

First, a survey of approaches to evaluation and assessment of these children exhibited three avenues of development: (1) The psychoeducational approach, (2) the psycholinguistic approach, and (3) the behavioral analysis approach. From this survey it is evident that education still has its major contribution to make in educational assessment. Further, a high probability exists that this advancement will be made both through instructional programing and through the assessment of entering responses to these programs.

Classroom management of these children, the second area surveyed, is a scene quite obviously dominated by education. Management is characterized by an endless variety of materials, methods, and recommendations for changes in instructional materials. Evaluation of the effectiveness of these methods is carried out largely by the impressions of teachers from gross observations.

An initial survey of professional programs in teacher preparation, the third area evaluated, reveals three predominant approaches to training: (1) The psychoeducational approach, (2) the structured approach, and (3) the behavioral approach. Within these programs are visible only very meager attempts to evaluate the effectiveness of teacher preparation quantitatively in terms of skills the teacher must demonstrate. Almost all attention has been given to certification as a basis for establishing criteria for teacher competency. Trends toward direct evaluation of teacher competency, however, are becoming visible within a few training programs.

Educational legislation was selected as the fourth area to evaluate because of the importance of leadership through legislative support to provide for children with learning disabilities. At the present time, legislation is in the initial stages of development.

The report presented by Task Force II should in no way suggest that the committee assumes these areas are the only areas relevant for assessment and management of these children. The areas of responsibility evaluated, however, are the areas which the committee felt could be productively singled out and handled.

The time and effort expended by the committee are not measurable unless it is through the contributions that effort, represented by this report, may provide the special field of learning disabilities. Special acknowledgement is due each member of the committee. Further appreciation should be extended to Barbara Bateman, Corrine Kass, Laura Lehtinen Rogan, and Jean Lukens for extra effort put forth in making their contributions.

The committee wishes to express its sincere appreciation to the sponsoring organizations without whose support the project could not have begun. Special appreciation

is extended to the National Institute of Neurological Diseases and Blindness, U.S. Department of Health, Education, and Welfare; the Easter Seal Research Foundation, National Society for Crippled Children and Adults, Inc.; the U.S. Office of Education, Department of Health, Education, and Welfare; and the Neurological and Sensory Disease Control Program, Division of Chronic Diseases, U.S. Public Health Service. The committee wishes further to express appreciation to Sam D. Clements, Richmond S. Paine, and Richard L. Masland for their contributions to the effort of the Educational Services Committee of Task Force II.

Acknowledgement must also be given to the following persons who read the draft of the report and contributed their comments and suggestions: Ray H. Barsch, William M. Cruickshank, Edward C. Frierson, William C. Geer, Samuel A. Kirk, Jeanne McRae McCarthy, Donald Mahler, Maynard C. Reynolds, and Charles R. Strother.

Final appreciation must be extended to Mrs. Mary Ann Hauck for her extensive contribution to the editing and rewriting of the report and to Mrs. Clara Sue Ball for refining and typing the manuscript.

NORRIS G. HARING,
The University of Washington.

MARCH 1968.

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SECTION I

Introduction

Norris G. Haring and Barbara D. Bateman

Planning was begun in 1963 for the establishment of a series of three task forces to study the status and needs of children with minimal brain dysfunction and/or learning disabilities. The collaborative project grew from a series of events (Strother, 1967) probably stemming originally from early mention of brain injured children by Strauss and Lehtinen (1947). Cruickshank, Bentzen, Ratzburg, and Tannhauser (1961) provided subsequent visibility to these children. Group action by parents, followed later by involvement of Federal agencies and a large number of organized professional groups (primarily medical with the inclusion of some educators and a few psychologists), focused more attention on these children. Four national agencies generously provided sponsorship: (1) The National Institute of Neurological Diseases and Blindness, U.S. Department of Health, Education, and Welfare; (2) the Easter Seal Research Foundation, National Society for Crippled Children and Adults; (3) the U.S. Office of Education, Department of Health, Education, and Welfare; and (4) the Neurological and Sensory Disease Control Program, Division of Chronic Diseases, U.S. Public Health Service.

Task Force I, a committee comprised primarily of medical personnel, dealt specifically with terminology and identification (Clements, 1966). The present report, compiled by the Educational Services Committee of Task Force II, is concerned with the areas of educational identification and assessment, educational practices, teacher training, and legislation. The Task Force III report, not yet completed, will summarize, evaluate, and make recommendations regarding basic and applied research.

While it would be inappropriate either to repeat or summarize the report of Task Force I, nevertheless, several important areas of agreement between Task Force I and Educational Services Committee of Task Force II should be underscored. Task Force II agreed with Task Force I that multidisciplinary communication, requiring precise, descriptive nomenclature, is essential for effective identification, assessment, and total management of these children. Secondly, it was agreed that both medical and educational assessment are essential for complete diagnosis. "The medical evaluation is essential to prevent the development or continuation of unsuspected disease processes. The behavior assessment provides the basis for a logical management and educational program" (Clements, 1966, p. 15). And thirdly, Task Force II concurred with Task Force I that ". . . differences exist in the objectives of the 'medical diagnosis' as opposed to the 'educational diagnosis.' Medical diagnosis is designed to investigate or demonstrate the existence of causative factors of disease or injury capable of amelioration or prevention" (Clements, 1966, p. 12). Medical evaluation may also further our basic knowledge of the existence and nature of relationships between the brain and behavior. Educational diagnosis, which assesses performance and capabilities, has as its objective "the establishment of appropriate remedial programs of management and education" (Clements, 1966, p. 14).

Problems in terminology arise when two different disciplines attempt a common description of the child to accommodate different purposes for obtaining diagnostic information. Viewing the child from the medical vantage point provides the physician the kind of diagnostic information relevant to ameliorating or preventing causative factors from disease or injury. For the educator who must approach the problem of identification from the purpose of child management in the classroom, however, a more functional and hence more behavioral definition is essential. The educator requires identification and assessment of learning disabilities which can be incorporated functionally into educational services, training, and evaluation.

Task Force I, dealing specifically with the problems of definition, terminology, and symptomatology, defined the children under consideration as those "near average, average, or above average in general intelligence, with certain learning or behavioral disabilities, ranging from mild to severe, which are associated with deviations of function of the central nervous system" (Clements, 1966, p. 9).

Consideration of the definition of children with learning disabilities provided by Task Force I, and recognition of the existence of such a group, led Task Force II, composed of educators, to four conclusions. Committee consensus held that to describe accurately the current educational status and to formulate realistic recommendations for these children, these children must be viewed as constituting an educationally heterogeneous group. Secondly, because special educators in the field of learning disabilities must base educational management and teaching strategies on functional diagnostic information, a redefinition of this group of children for educational purposes was required.

Thirdly, any reference to "estimates of potential" should be broadened to incorporate the large numbers of children who fail to score "near average" on intelligence tests. Much of the pioneer educational work in learning disabilities has been done with children who, because of very severe, specific disabilities, could not initially score above the mentally retarded range on any accepted measure of general intelligence. Further, school psychometrists and psychologists should not be given the unrealistic burden required of making estimates of potential.

Fourthly, effective educational identification and specifications for remediation of learning disabilities are functional without any reference to associations with functional deviations of the central nervous system. Identification of an educational deficiency is adequate for remediation plans with or without positive neurological signs. Further, requirements of positive neurological signs might preclude or delay necessary remediation.

The inability of the educationally oriented Task Force II to operate comfortably within a medical framework should be neither surprising nor disappointing. The matter of defining learning disabilities in a way that has educational relevance and utility is clearly not simple. Basic guidelines in the development of educational definitions of children with learning disabilities should establish definitions which encourage (1) facilitation of services for children; (2) breadth for inclusion of all children needing these services; (3) exclusiveness for avoidance of inefficient overlap with other services; and (4) flexibility.

Notable among recent educational definitions is that of the Council for Exceptional Children, Division for Children with Learning Disabilities, which is presented as a "working" definition:

> A child with learning disabilities is one with adequate mental ability, sensory processes, and emotional stability who has specific deficits in perceptual, integrative, or expressive processes which severely impair learning efficiency. This includes children who have central nervous system dysfunction which is expressed primarily in impaired learning efficiency (Barsch, 1967).

The statement of position on learning disabilities provided by the same council underscores the curriculum as the standard setter for performance. "Inability to meet such standards constitutes the foundation of a learning disability. A learner has an educational disability when he cannot consistently meet the demands of the curriculum to which he is assigned" (Barsch, 1967).

Another recent educational definition is that of Kirk (1967):

> A learning disability refers to a specific retardation or disorder in one or more of the processes of speech, language, perception, behavior, reading, spelling, writing, or arithmetic.

Kirk uses the concept of discrepancies among the child's own levels of development and points out that his use of "specific" refers to a definite retardation which is at variance with relative assets. Within this framework there are children who would be considered as only learning disabilities and others who would show additional handicaps such as mental retardation or blindness.

The National Advisory Committee on Handicapped Children (1967) developed the following definition as a clarification of the identity of children with learning disabilities:

> Children with special learning disabilities exhibit a disorder in one or more of the basic psychological processes involved in understanding or in using spoken or written language. These may be manifested in disorders of listening, thinking, talking, reading, writing, spelling, or arithmetic. They include conditions which have been referred to as perceptual handicaps, brain injury, minimal brain dysfunction, dyslexia, developmental aphasia, etc. They do not include learning problems which are due primarily to visual, hearing, or motor handicaps, to mental retardation, emotional disturbance, or to environmental disadvantage.

Task Force II also attempted to define this group of children in a universally acceptable fashion. Among the definitions which emerged were:

> Children with learning disabilities are those (1) who have educationally significant discrepancies among their sensory-

motor, perceptual, cognitive, academic, or related developmental levels which interfere with the performance of educational tasks; (2) who may or may not show demonstrable deviation in central nervous system functioning; and (3) whose disabilities are not secondary to general mental retardation, sensory deprivation or serious emotional disturbance.

Children with learning disabilities are those (1) who manifest an educationally significant discrepancy between estimated academic potential and actual level of academic functioning as related to dysfunctioning in the learning process; (2) may or may not show demonstrable deviation in central nervous system functioning; and (3) whose disabilities are not secondary to general mental retardation, cultural, sensory and/or educational deprivation or environmentally produced serious emotional disturbance.

Since none of these proposed definitions is acceptable to all educators, it is unlikely that any one educational definition could find total acceptance at the present time. Other areas of special education have a similar problem. A child's mental retardation, giftedness, or visual handicap may exist or not exist as a function of where he is and what the situational expectations and requirements are for him at that point in time. The relative nature of educational definitions is particularly relevant to learning disabilities which, perhaps more than for any other handicap, are dependent on the setting.

It is not incumbent upon Task Force II to propose *the* definition of learning disabilities. What is highly important is to recognize that any educational classification of children must always be secondary to, and for the purpose of, providing maximally effective learning environments. Definitions should vary as they are designed to facilitate educational adaptations within a particular content and must identify behavioral components that are functional to educational treatment.

The total report of Task Force II is designed to be responsive to the present educational status and services for children with learning disabilities and to the changes in services, training, evaluation, and legal status essential for amelioration and prevention of these disabilities. Sections 2 through 5 provide summaries and evaluations of the current status, services, and needs of children identified as learning disabilities relevant to (1) educational identification, assessment, and evaluation; (2) education, administration, and classroom procedures; (3) professional preparation; and (4) legislation. A series of recommendations is provided following each chapter. Final recommendations follow all chapters.

Section 2 provides a review and evaluation of procedures and instruments used in educational identification, assessment, remediation, and evaluation of children with learning disabilities beginning at the preschool level, reviewing both the theoretical and the behavioral approaches. Recommendations encourage effective communication, economy in diagnosis, critical evaluation and refinement of assessment procedures and instruments, operational definitions, functional evaluations, and prevention of the many learning, i.e., teaching, disabilities.

Section 3 presents a survey of existing instructional services in public schools and the operational framework of programs for these children, obtained from a four part questionnaire sent to school administrators of special programs and to teachers and therapists working with children having learning disabilities. Information was obtained on (1) the legal category and nomenclature identifying the programs; (2) the types of educational services provided; (3) the administrative structure employed; (4) eligibility criteria and diagnostic procedures; and (5) the extent of services. Discussions of the present state, trends, issues, and recommendations relevant to each of these five categories are provided.

Educational services provided by professional training programs are reviewed in section 4. Evaluation of the content of each program is made in terms of levels of refinements in instruction observable from program descriptions and reports. Present degrees of refinements in instruction observable in these training programs are compared to refinements called for from accreditation standards, certification standards, and from research in teacher education. Utilization of procedures for evaluation of teachers and training programs are evaluated from criteria underscored by research. Recommendations for refinements necessary to an effective training program include (1) establishment of performance criteria operationally defined; (2) utilization of systematic observation procedures; and (3) incorporation of built-in procedures for evaluation of teacher performance and training program effectiveness.

A description of Federal and State legislation provided in section 5 reviews the extent of legal provisions for children with learning disabilities, the extent of Federal funds for training professional personnel, the extension of coverage that is feasible now from existing State legislation, the inadequacies of present legislative provisions, the legislative provisions yet to be established, and the types of visible State action toward improvement of legislation. Recommendations are made for incorporation of the terms "specific learning disabilities" by name or synonym into State and Federal laws.

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SECTION II

EDUCATIONAL IDENTIFICATION, ASSESSMENT, AND EVALUATION PROCEDURES

Barbara D. Bateman and Richard L. Schiefelbusch

A thorough description and evaluation of all the procedures and instruments currently used in the educational identification and assessment of children with learning disabilities is beyond the scope and intent of this report. Rather, the attempt here is to describe some prevalent practices and to make recommendations about possible future directions.

The choice of procedures used in the identification and evaluation of children with learning disabilities depends on many factors such as the examiner's philosophy regarding the nature and purpose of educational diagnosis, the professional training and skills of the examiner, the time and funds available for diagnosis, laws or regulations regarding tests to be used in determining a child's eligibility for special services, possible limitations imposed by the child's age and disabilities, the use of diagnostic data for research purposes, and many other variables.

In order to treat even briefly the varied and divergent procedures and tests used, it has been necessary to use headings which are only crudely descriptive. These headings are in no way meant to reflect anything other than one way of classifying some of the many educational assessment techniques currently used. The headings, which provide the basis for the organization of this report, are: (1) Procedures to determine whether a child has a learning disability—i.e., whether he is in need of, or eligible for, an educational program designed for children with learning disabilities; (2) procedures to determine the specific kind of educational or teaching program to be provided once eligibility and/or placement has been determined; (3) functional analysis of behavior.

PROCEDURES FOR DETERMINING ELIGIBILITY OR CLASSIFICATION AS A LEARNING DISABILITY

Early identification of potential learning disabilities before they are manifested as failure in school and the diagnosis of manifest disabilities after school failure require somewhat different orientations and are discussed separately in the following sections. A primary distinction which might be kept in mind is that measures of academic functioning in the strictest sense cannot be obtained on preschool children so the concept of discrepancy between academic performance and potential cannot be employed.

IDENTIFICATION OF POTENTIAL LEARNING DISABILITIES IN THE PRESCHOOL YEARS

As is true in many areas of health, education, and welfare today, there is increasing emphasis on early identification of potential learning disorders, with the intent of providing preventive programs. The role of medical evaluation looms necessarily large at the early ages because (1) there has as yet been no opportunity for school learning problems to occur, (2) psychological tests at the early ages are generally less reliable than at older ages, and (3) while few educational-psychological institutions have yet established screening programs which reach large numbers of preschoolers, these children are, however, seen by medical personnel.

A few communities are now initiating preschool and nursery screening projects which involve cooperative efforts by medical, psychological, and educational personnel. Data from such projects will hopefully alleviate our current paucity of knowledge about subtle prognostic signs in young children (Beery, 1967). Many of these youngsters are seen by medical personnel first—often when the parents begin to note such symptoms as delayed language, hyperactivity, poor motor coordination, lack of responsiveness, or uncontrolled temper outbursts.

Nursery school personnel also encounter some of these children, but at the present time there is little consensus about appropriate educational programing for 2-, 3-, and 4-year-olds showing these atypical behaviors. Recommendations which are offered include variations of "Don't do anything, as he is normal and will outgrow it," "He can't tolerate limits so remove them," "Socialize him," and "He needs very firm discipline and careful structuring of an early educational program." Our knowledge of accurate predictions and prevention of learning disabilities in 3- and 4-year-olds is inadequate and bespeaks a need for:

1. Further dissemination of information describing children with learning disabilities to all agencies and personnel involved in early contact with these children.
2. Data on recommendations which are made and their relationship to the children's consequent development. Parent groups could be of great assistance in determining what kinds of recommendations are actually being made by professionals and what outcomes seem to accrue.
3. Funding of community screening projects involving multidisciplinary approaches which offer unique opportunities for service, training and research.
4. Development of reliable and valid psychological tests for this age level even though such efforts are fraught with problems. Behavioral observations and normative developmental data will probably continue to comprise the bulk of our objective assessment techniques.

Among standardized tests which may be useful in psychological assessment of suspected learning disorders in 3- and 4-year-olds are the Illinois Test of Psycholinguistic Abilities, the Beery-Buktenica Test of Visual-Motor Integration, the Draw-a-Man, the Stanford-Binet Intelligence Scale, the Basic Concept Inventory, the Wechsler Intelligence Scale for Children, the Wechsler Preschool Primary Scale of Intelligence and the Frostig Developmental Tests of Visual Perception (see test appendix).

Many more systematic evaluation techniques are available for the kindergarten age group. At this level the interdependence of identification and definition becomes both complex and important. Educators readily recognize that definition plays a large role in the identification techniques employed, but it is just as true that we often define that group we are *able* to identify. Traditional school readiness tests most readily identify the child of below average ability. A major difficulty in identifying a child with potential specific learning difficulties at the 5-year level is in separating him from the generally slow learning child. The concept of discrepancies within the child's levels of cognitive and perceptual growth is important here, in contrast to the concept of discrepancy between his estimated potential and actual functioning. Kindergarten teachers asked to describe the children of average or higher intelligence who they feel are likely to have trouble meeting the academic demands of first grade frequently mention short attention span and "immaturity." Techniques to assist kindergarten teachers in refining their differentiation of generalized retardation or immaturity and specific learning problems are being developed. At the present there are few data to suggest unequivocally that formal testing is more successful in finding potential problems than is sophisticated teacher observation.

A notable preliminary study of prediction of future academic failure of kindergarten children is that of De Hirsch, Jansky, and Langford (1966). From an original battery of 37 tests, a Predictive Index of 10 tests was found to identify 91 percent of the kindergarten children who later failed at the end of the second grade. These 10 tests were: Pencil mastery (ratings of grasp and control based on age expectancy), Bender Visual-Motor Gestalt test (six of nine figures used and scored on response to essentials of Gestalt, degree of differentiation, and ability to organize figures in space), Wepman Auditory Discrimination Test (20 alternate pairs), Number of Words (total number of words used in story telling, after Dorothea McCarthy, "The Language Development of the Preschool Child," University of Minnesota Child Welfare monograph 4, 1930), Categories (ability to produce generic names for three clusters of words), Horst Reversals Test (only matching of letter sequences was employed), Gates Word-Matching Test (abbreviated version), Word Recognition I (ability to pick from a pack of successively presented cards the words "boy" and "train," which had been taught at the beginning of the session), Word Recognition II (identifying same words exposed on the table with eight others), and Word Reproduction (write from memory as much of the two words as he could recall).

The authors point to certain limitations in the study, e.g., the small number of children who failed. Nevertheless, it is an effort to refine objective methods of identifying potential learning disabilities at the kindergarten level.

There is little doubt that within a few years it will be possible to accurately identify a substantial proportion of those 5-year-olds who, in the absence of intervention, will later fully qualify as children having learning disabilities. Marked increase in the number and extent of such screening efforts will probably be seen. Two questions which appear to be looming are: (1) Is it possible to provide adequate and appropriate preventive programs for the children so identified? and (2) will the increased referral rate be a significant problem? If parents and teachers expect a child to have learning problems because he was identified in a screening project, will this expectation produce an otherwise nonexistent disability? The incidence of learning disabilities is sure to rise with the increased use of screening measures. A point of diminishing returns may be reached, therefore, in identification of subtle learning problems.

Group tests used in kindergartens to identify youngsters with potential learning problems include Screening Tests for Identifying Children with Specific Language Disability (Slingerland), Detroit Tests of Learning Aptitude, and many other instruments. Most of the tests mentioned at the 3- and 4-year level are also appropriate at the 5-year level (i.e., Frostig Developmental Tests of Visual Perception, Beery-Buktenica Visual-Motor Test Integration Test, etc.).

Individual tests useful at the kindergarten level include the Predictive Index (De Hirsch), Dyslexia Schedule (McLeod), the Illinois Test of Psycholinguistic Abilities (Kirk and McCarthy), Basic Concept Inventory (Engelmann), and other tests such as those included in the test appendix.

DETERMINATION OF LEARNING DISABILITIES IN SCHOOL-AGE CHILDREN

Within the framework of many educational definitions and settings, the diagnostician frequently attempts to establish that the child shows (1) a discrepancy between measures of intellectual, cognitive, or academic potential and current level of performance; (2) dysfunction in the learning processes, and (3) absence of other primary factors such as mental retardation; cultural, sensory and/or educational inadequacy; or serious emotional disturbance. In addition, some States or clinics require direct evidence of cerebral dysfunction, which will not be discussed here as it has been presented by Task Force I on minimal brain dysfunction in children (Clements, 1966).

In order to determine that a significant discrepancy exists between academic potential and academic functioning, it is clearly necessary to assess both and to examine the difference. Neither assessing them nor evaluating what constitutes a significant discrepancy is an entirely straight-forward, objective procedure, however. The usual way to assess academic potential is through use of an individual test of intelligence such as the Binet or WISC. With all the difficulties inherent in the fact that performance on such tests is influenced by the very factors one is looking for (learning disability, educational deprivation, etc.), yet there is to date no widely accepted superior method of estimating academic potential. There is, however, a growing question as to the academic potential when the correlation between them and academic achievement is relatively low. Yet, this is sometimes necessary in order to show a large enough discrepancy to make the child eligible to receive special educational services.

Measuring academic achievement is considered (correctly or incorrectly) somewhat more objective than measuring intellectual potential. Scores on standardized achievement tests, school grades, retention in a grade, teacher referral, etc., may all be accepted under some circumstances as adequately valid and reliable indicators of achievement. Proper cautions are required in cases where a severe reading disability is reflected in achievement scores in other areas such as arithmetic reasoning, where group administration procedures fail to prevent copying, where the achievement test content is not highly correlated to a particular curriculum or its objectives, and in related circumstances.

Tests used in assessing academic achievement include standard achievement batteries such as the California, Stanford, and Metropolitan batteries commonly used in schools. The Wide Range Achievement Test is most frequently used as a quick individual test, although two sections of it may be used with a group. Specific reading achievement tests include the Gates series of tests, the Gray Oral Reading Tests and many other similar instruments. Special tests of arithmetic and spelling achievement are also available but are used comparatively infrequently.

The question of how large the discrepancy between potential and functioning level must be to constitute a learning disability is sometimes arbitrarily answered for the diagnostician by existing State or school regulations. For example, at least one State requires a 2-year discrepancy between mental age and reading age before the child is eligible to receive special help. This has the obvious advantages of being objective and of covering the large majority of severe reading disabilities in the lower and middle grades. The disadvantages of rigidity in unusual cases and the imposition of a minimum of 2 years of nearly total reading failure before services can be initiated are equally obvious. According to some educational definitions, a first-grader whose achievement is perhaps only a few months below his expected level (mental age or some function thereof) may qualify if other evidence suggests possible worsening of the problem and if intervention is possible. Questions are often raised about the very bright child who is achieving at grade level, but who still shows a large discrepancy between potential and functioning. In fact, achievement-oriented parents are sometimes more concerned about such a child than are school personnel.

A flexible concept of "educationally significant discrepancy" seems eminently desirable at this stage of the development of identification and intervention techniques. It would not be altogether facetious to suggest that a retrospective determinaion of the significance of the discrepancy be made by asking whether there is, in fact, something that can be done about the child's achievement problem. If there is, then the discrepancy is significant and the child has a learning disability. If there is not, perhaps he should not be so labeled.

The diagnostician may wish to examine whether the child shows disorders in the learning processes. Here the diagnostic procedures are often more subjective or clinical and include the use of instruments less well standardized, in a normative sense, than the common measures of potential and achievement. This portion of the diagnostic process may be described as the assessment of psychological correlates of the disability. For instance, gross deficiencies in auditory memory, spatial concepts, sound discrimination, time orientation, etc., would be considered disorders of learning processes which could be related to school achievement problems.

Some of the tests used in exploring possible disorders of the learning processes are closer to criterion-referenced than to norm-referenced instruments, in underlying philosophy if not in actual format. For instance, comparatively few normative data are available on such factors as sound blending or letter reversals. These might be thought of as "either-or" rather than strictly "developmental" aspects of learning. A child's sound blending ability either is adequate to perform the task of recognizing a word from its separated sound components, or it is not. A large number of the tests employed in this phase of diagnosis may be described as primarily visuo-motor or auditory-vocal. This distinction is similar to that between performance and verbal items. Also, a growing number of tests are beginning to appear which are related to tactile-kinesthetic functions, inter-sensory integration, and spatial-temporal awareness.

Tests related to visuo-motor functioning include the Illinois Test of Psycholinguistic Abilities subtests of visual decoding, visual-motor association, motor encoding, and visual-motor sequential; the Draw-A-Man Test; Memory-for-Designs Test; Benton Revised Visual Retention Test; Beery-Buktenica Visual-Motor Integration Test; Frostig Developmental Tests of Visual Perception; Bender Visual Motor Gestalt Test for Children; and the Purdue Perceptual-Motor Survey.

Tests related to auditory-vocal functioning include the Illinois Test of Psycholinguistic Abilities subtests of auditory decoding, auditory-vocal association, vocal encoding, auditory-vocal automatic, and auditory-vocal sequential; Parsons Language Sample; Basic Concept Inventory; Mecham Verbal Language Development Scale, and the Roswell-Chall Auditory Blending Test. Another test which explores the learning processes is the Learning Methods Test.

A diagnostician may be concerned with ruling out mental retardation, serious emotional disturbance, and educational, sensory, or cultural inadequacy as primary factors in the disability. In-depth consideration of serious emotional disturbance and sensory deprivation would seem to require other than educational techniques and personnel and will not be discussed here. This is but one reason the team or clinic approach is essential within a comprehensive concept of diagnosis. Case history information may be helpful in assessing possible educational and cultural deprivation. Finally, the distinction between mental retardation and learning disabilities is usually made on the basis of intelligence test scores, the presence of large discrepancies within the various learning processes, and the availability of educational services for the two distinct classifications (note that "distinct" modifies classifications, not necessarily children). Whether a distinction always can and should be drawn between mental retardation and learning disabilities has now become academic, at least within the kinds of definitions formulated by Task Force I and the Council for Exceptional Children which require that children with substantially below average intelligence be excluded from the category of learning disabilities. Other educational definitions specifically allow latitude in "estimating potential intelligence" regardless of test scores. Even so, it remains a troublesome question for local educators struggling with placement problems.

The role of referent groups, for instance the classroom, must be carefully evaluated in some suspected learning disability cases. If a child of average intellectual functioning is placed in a class where the mean ability level is extremely high, he may appear to be performing quite poorly. This is not an infrequent problem for average children of highly achievement-oriented parents. It often becomes important for the diagnostician to ascertain the general achievement level of a school or particular classroom in order to understand why the child's performance level has been perceived by the teacher or parent as less than adequate. It is also possible, although seldom observed or noted, that severe learning disabilities may go undetected in a child of very high ability who is placed in a low or low average classroom or school.

Procedures for Planning Educational Techniques and Programs

Once it has been established through various assessment procedures that a child does have a learning disability, the primary educational question of what to do about it is next. This is not to say that entirely different tests or procedures must now be employed but rather to suggest that new questions must be considered. The issue is no longer whether the child has a disability, but rather what should be done about it. Specific educational recommendations must be forthcoming.

The question of the efficacy of deriving remedial procedures from the diagnostic processes to be described still awaits definitive, data-oriented resolution. In this discussion it is assumed that making specific educational recommendations for the use of materials or techniques other than those routinely employed in the regular classroom is a necessary and legitimate part of this phase of educational assessment.

The process of psychoeducational diagnosis conducted to make recommendations for prescriptive or individualized teaching is based, implicitly or explicitly, on a model of cognitive-perceptual functioning (Strother, 1966). The diagnostician uses some sort of model to guide him in choosing areas to be assessed. Popular and representative models utilize computerlike categories of the child's functioning or potential dysfunctioning: input (sensory modalities and attention), integration (intersensory and associative), output (motor and vocal response systems), storage and retrieval (memory) and feedback, etc. (e.g., Gallagher, 1962). Just as diagnostic tests can be described in terms of the portion of the cognitive-perceptual map they explore, so remedial techniques and materials can be described and related to each other and to tests in terms of the cognitive-perceptual areas they are designed to exercise or develop (Frostig, 1967). Thus, one of the main jobs of the diagnostician operating within this framework has been to know tests and relatable remedial techniques and materials which cover all the major areas of dysfunctioning found in children with learning problems.

For example, a child might have a problem which is described in global behavioral terms by the teacher or parent as an inability to follow verbal instructions. The diagnostician must then be prepared to observe and assess such possible specific areas as dysfunctions in temporal sequencing, auditory closure, auditory discrimination (probably with help from audiologic disciplines), comprehension of structure and function of various linguistic patterns, speed of auditory perception, immediate auditory memory, attention to auditory stimuli, integration of auditory symbols and visual referents, etc. (see Myklebust, 1954; Reichstein and Rosenstein, 1964).

The problem might be of a different sort in which totally different tests or types of observation would be appropriate. If, for instance, the presenting difficulty was poor handwriting, the diagnostician might be required to assess such diverse functions as fine muscle control, eye-hand coordination, visual perception or body image. If the disability presented itself as difficulty in acquiring sight vocabulary, he might need tests of visual memory or aptitude for learning through tactile-kinesthetic reading methodologies.

In short, the diagnostic-remedial or psychoeducational approach (as it is sometimes called) to children's learning problems requires that the diagnostician know what receptive or perceptual, integrative or cognitive, expressive or response processes underlie complex behavioral products like reading, speaking, or writing and be prepared to assess them in as much depth as is required to find specific deficits and to plan strategies for reducing or circumventing these disabilities.

The levels or degrees of precision with which an area of dysfunction is diagnosed or explored vary. The following illustrative example shows various points at which a tester might stop assessing and begin making recommendations.

Barry was referred to the school's psychoeducational diagnostician by his third grade teacher who reported that he seemed to be capable of doing better work than he was currently doing. The diagnostician might have proceeded as described below.

1. Administration of the WISC revealed Barry's verbal IQ to be 120 and his performance IQ 103. Barry's reading grades were consistently D and his last achievement test showed him to be reading at 2.3 grade level, even though he is 9 years old.

   At this point the diagnostician might stop and simply conclude that Barry is eligible to receive remedial reading under State or district regulations and so recommend.
2. Further examination of the WISC scaled scores revealed that Barry scored significantly poorly (see Newland and Smith, 1967) in coding, digit span, and information. Further reading tests revealed he read very rapidly and inaccurately, freely supplying incorrect words which seemed to him to be in context. His knowledge of phonics and word attack skills was limited to moderate mastery of simple consonant sounds. He showed total confusion on vowels. His sight vocabulary was generally adequate for second grade but definitely stronger for distinctive words such as "elephant" or "balloon" than for the troublesome "when," "with," "they," etc.

   The diagnostician might stop at this point and recommend that Barry be given a phonically oriented remedial approach with special emphasis on careful attention to each word part. He might also conclude that Barry needs work in attending (digit span), perceptual speed training (coding), etc.
3. Since Barry's cluster of low WISC subscales is not at all uncommon in that type or types of reading problems called dyslexia, and since his reading difficulties in sound symbol association, differentiation of similar words, etc., are also not inconsistent with dyslexia, the diagnostician might continue testing with other instruments. He might do "dominance" testing, since this is said by many to be related to dyslexia. He might administer the ITPA, the Bender, the Frostig, etc. If Barry showed deficiencies in auditory-vocal sequencing and visual-motor sequencing, he could then say with greater certainty that Barry was dyslexic. The Bender and Frostig might well reveal some visual-motor perceptual problems. The Purdue might then be administered to gain further information about the perceptual-motor aspects of Barry's problem.

   This process of further, related testing might continue indefinitely, limited only by time and the diagnostician's knowledge of available tests. If the test results continued to be consistent with dyslexia and in particular showed up visual-perceptual problems and body image problems, additional recommendations for Getman, Kephart, or Frostig (etc.) remedial programs might be made. Such remedial recommendations are again limited only by the diagnostician's knowledge of what is available and the availability of a capable tutor who is familiar with the materials.

This procedure of further testing and interrelating findings on one test to those on another and exploring related disabilities can be continued with ever increasing sophistication and remoteness from the presenting symptom of inadequate word attack skills in reading. A point of diminishing returns might be reached in this pursuit for several reasons, however. Among them are: (1) Inadequate factor analytic studies of definitions and relationships among functions tested by the commonly used instruments; (2) inadequate knowledge of relationships between functions or processes tested (e.g., spatial relations) and other behavioral disabilities such as spelling or writing; (3) lack of refined, differentiated, systematic remedial procedures for these "process" disabilities; and (4) inadequate verification of the efficacy of "process" training in overcoming other behavioral disabilities. This latter problem might be rephrased in terms of the sufficiency for and necessity of "process" (underlying disability) training prior to or concommitant with direct remediation (e.g., teaching short vowel sounds).

In general, the rationale for this kind of extensive diagnostic exploration is that the child possibly has some kind of correlated or underlying "process" disability which has so far prevented his adequate response to ordinary methods of teaching skills. This correlated disability should be remediated first (e.g., auditory closure taught, or auditory memory improved); then the child can more easily learn the skills (e.g., phonic word attack skills). This rationale is used by the "teach to his weakness and improve it" proponents (e.g., Kirk, 1966). The "teach to his strength" proponents (e.g., Cohn, 1964) advocate the above kind of diagnostic testing to find intact areas so that instruction can be redirected to those channels or processes through which he can learn most readily. Some advocate direct remedial teaching, usually on an individual basis, in his areas of weakness *and* simultaneous restructuring of instruction, usually on a group basis, so that he is exercising and learning through his intact perceptual-cognitive processes.

Two separate questions which are not always treated as separate are *what* to teach and *how* to teach it to the child with learning disabilities. Some psychoeducational diagnoses appear to have dealt more extensively with the how than with the what of teaching these children. Consequently the *what* of teaching has sometimes been trivia. For instance, some are now questioning the educational relevance of large amounts of remedial bead stringing, puzzle assembling, and so on (Engelmann, 1967).

These kinds of tasks are generated in attempts to fulfill prescriptions for the development of visual memory or visual closure, etc. But the diagnostician may have neglected to ask what tasks the child needs to learn for which visual memory or closure is required. If that question had been asked, it is possible that different recommendations might have been forthcoming and that the tasks generated would more nearly resemble the important educational outcomes desired. The child might, for example, be exercising or developing visual memory by using letters or number symbols rather than beads.

To inventory the tasks a child needs to be taught requires survey instruments and procedures such as parent or teacher interview techniques which are highly specific and behaviorally oriented. For instance, it is of no help to anyone for the diagnostician to state that the child needs remedial reading. This general *what* is obvious. The problem is determining the specific *what* within the large realm of behaviors or tasks called reading that he needs to learn. Similarly, a parent's report that the child needs to become more independent at home is of little help. The diagnostician must be prepared to establish that he doesn't dress himself at all or can't tie his shoes or doesn't ever play alone, etc. Comparatively few survey instruments of this specific behavior-to-be-learned type are available. Among these few are phonics inventories and social competency measures such as the social maturity scale of the Valett Developmental Survey of Basic Learning Abilities, the Vineland, the PAC, and the Cain-Levine Social Competency Scale. In the language area, items from the auditory-vocal automatic and vocal encoding subtests of the ITPA perhaps represent specific tasks which should be taught directly to the child who is deficient in them. These are the kinds of tests about which the diagnostician can say to the teacher, tutor, or parent, "Teach the failed test items as directly as you can." They are viewed as important tasks which the child cannot yet perform, and they seem to be next in line to be learned, either developmentally or in terms of priority due to the nature of the task (Valett, 1967).

FUNCTIONAL ANALYSIS OF BEHAVIOR

Functional analysis of behavior as an approach to children's learning disabilities overlaps both of the preceding sections through incorporation of procedures for describing specific deviant behaviors and through provision of a system—both scientific and methodological—for planning and executing remedial strategies.

Functional analysis of behavior is rooted in a history of exacting scientific research and incorporates salient features of the scientific method. Functional analysis has only recently been adapted to the task of analyzing complex behaviors observable in behavior disorders, socialization, or academic performance during skill acquisition as in reading. Although the use of functional analysis is recent, it has already been applied systematically in at least three settings or arrangements pertinent to learning disabilities: (1) Arrangements within highly controlled environments such as specialized treatment facilities (laboratories), (2) arrangements within natural environments accomplished through direct or indirect programing by the behavioral scientist, and (3) arrangements in natural environments accomplished by practitioners or parents who have been trained by the behavioral scientist.

In each instance or setting the evaluational analysis is similar in structure and strategy, i.e., the data employed is a record of actual, explicit events—the responses of the subject and the antecedent and consequent events temporarily related to the responses.

The general strategy of evaluation is essentially a two-step procedure first of obtaining baseline data (a pretreatment measurement of the performance or behavior pattern) on the specific behavior to be changed and then assessing the conditions that maintain the behavior. These conditions include the stimulus events, the responses, the contingency system, and the consequences within the learning environment in which the child is to perform. To illustrate briefly, if a child is referred for hyperactivity the first step in the evaluation procedure is to determine what behaviors are observable in his hyperactivity, e.g., foot tapping and ear pulling, and then to observe and count instances of those behaviors per minute (or other time unit) under a range of conditions. When the baseline data (rate of specific behaviors over several observations) is obtained, the second step is an assessment of the environmental conditions that cue and consequate foot tapping and ear pulling.

PERFORMANCE BASELINES

The techniques for establishing a baseline of relevant performance presupposes that the evaluator knows precisely what class of specific behavioral units he wants to assess. For instance, forms of vocalization, body movements, object manipulations, acquisition of sight vocabulary, completion of assigned work, or disruptive behaviors in the classroom might be the source of concern or the target behaviors to be studied. "Pinpoint" recording can be attained when such specific behaviors are observed. Either simple or complex units can be recorded per unit of time, enabling behavioral rates to be established for a specified number of response classes. The topography (form or exact description) of relevant behaviors also can be described selectively or generally. Specification of the *topography* of the responses is important to subsequent plans for modifying the behavior, and the *rate* is important as an indicator of the effectiveness of the reinforcers or contingencies used during training.

The aim in establishing baselines for relevant behaviors is to establish the total range of variability for the child under different conditions or stimulus arrangements. Thus the baseline should not be a product of one observation, but rather should be based upon a continuous assessment of behavior over a period of time until a functional range has been obtained. The evaluator also should be concerned not only with the reliability of baseline performances but with the validity of his evaluations. This is largely assured by the objective nature and the quantification of the observations. In addition, the recorded behaviors can be exactly matched to those the evaluator will subsequently seek to modify. Therefore, the validity and the predictive value of the recorded data should be appreciably higher than that derived from standardized tests that sample a range of performance and are used as indirect or inferred indicators for performances in the behavior areas in question.

ANALYSIS OF BEHAVIORAL COMPONENTS

The second aspect of the proposed evaluative process is the assessment of those behavioral components that maintain and modify behavior, i.e., *antecedent* or *stimulus* events, behavioral *movements* or *responses,* the *contingency system* used to program consequences, and the *consequences* which are contingent upon a specified behavior (Lindsley, 1964; Lovitt, 1967).

Antecedent or stimulus events.—The baseline recording procedure described above alerts the teacher to the child's pattern of behavior. The baseline data also provide useful information for the teacher in planning specific instructional arrangements. If this is to be the intent, the baseline data should be obtained from responses made to events similar to those to be used later in changing the behavior. Since the evaluator cannot recreate the learning history of the child step-by-step, he may instead observe the child's response rates or patterns (preferences) to a variety of classroom materials, to the behavior of peers, and to the teacher's modes of instruction and interaction. For example, the evaluator can obtain valuable information by letting the child select his own preferred rate of visual or aural presentation, the intensity or brightness of the aural or visual stimuli, and/or the configuration or size of the visual stimulus (Lovitt, 1967). Teachers in aural rehabilitation classes do this routinely when they let the child set the loudness level on auditory training equipment. Another method is to vary arbitrarily the stimuli (such as the loudness) and to observe the changes in the child's responses. Changes in the materials and in modes of instruction will produce changes in response patterns; consequently, these must be held constant while observations and measurements are made to determine the baseline levels of responding.

Movement or response behaviors.—As various stimuli are presented, changes in the child's responses must be continuously recorded. Stimulus events themselves thus give additional diagnostic meaning to the response levels and variability. Response changes may be noted in rate of speaking or moving, the length of response units, or the extent of sustained responding.

Reinforcement or contingency system.—Many of the educational and social deviations displayed by children with learning disabilities could result from infrequent or sporadic contingencies or reinforcements. Although most normal children seem to prosper on a fairly lean schedule of reinforcement, many children with behavioral deficits often fail to respond, or respond at very low rates on intermittent schedules. The contingency rates required to accelerate or to maintain the desired behavior is an important indicator for subsequent instructional programing and should be assessed. For example, a normal child may achieve well with only the 6-week's grade as reinforcement while the child with learning disabilities might require charting progress in performance every day or even every hour.

Subsequent or consequent events.—It is necessary to identify an individual's hierarchy of consequences—those particular commodities or events that either increase or decrease his rates of performance. Those consequences should be selected which ultimately will be available in the child's home or school and whenever possible they should take the form of the complex social consequences that will eventually control his behavior (Lovitt, 1967). But it is often necessary initially to use simple, tangible consequences. For most children a variety of reinforcers is likely to have consequence value. The first objective then is to select commodities that will have consequence value and thus will accelerate the child's rate of response.

Tokens, points, or checkmarks are sometimes used as currency which enables a child to select and "purchase" his own tangible or social reinforcers. In this way consequent events may have greater strength for evoking and sustaining effort. Contingencies and social reinforcers in such a learning situation are under the direct control of the adult.

THE DYADIC UNIT

In many diagnostic evaluations it may be necessary to assess the referring agent—the teacher or parent—as well as the referred child (Lovitt, 1967). Often it is the pattern of interaction between the child and adult rather than just the child's behavior which must be modified. More specifically, it may be desirable to consider the stimulus-response chains or pattern within the dyadic (two-person) unit. The two members of the unit provide sequential contingencies for each other. Each provides preceding responses which become stimuli for the next response of the other, and each establishes the contingency and the subsequent event (feedback) to the other as well. In the classroom, for example, some teachers respond to a child only when he is emitting undesirable behavior, an action which simply increases the probability of more of the same behavior. Rather, they should be reinforcing him for the desired behaviors to increase the probability of these desirable behaviors.

This discussion of functional analysis is limited to behavioral assessment and does not treat the behavior modification procedures derived directly from the assessment data gathered. Application of behavior modification techniques necessitates consideration under remediation or program implementation. A bibliography of behavior modification literature pertinent to learning disabilities is included, however.

GENERALIZATION OF EVALUATION

The intent in studying behavioral functions should be to effect an optimum environment for learning. In terms of the diagnostic remedial approach discussed earlier this necessitates rephrasing to state that the purpose of the diagnosis is to plan remediation. Given the information specified above, the teacher or clinician presumably should be able to plan for a stable, effective learning environment. The teacher should seek to generalize the arrangement of effective learning conditions to an extended time frame and to a range of formal and informal settings. This can be done by maintaining a cumulative record of performance data in order to make ongoing educational decisions.

Discussion and Future Considerations

This brief overview of the educational appraisal of learning disabilities has been broadly divided into two types of procedures—those for determining that a learning disability exists or is likely to develop and those for planning intervention strategies or remedial steps to minimize the effects of the disability. Both approaches address themselves on occasion to specific academic bits of behavior such as learning or teaching short vowel sounds, but there is still ample room in the field of educational appraisal of learning disabilities for greater attention to the systematic determination of precise educational deficits. Most traditional achievement testing is far too global. Among the promising future trends in the evaluation of learning disabilities will be greater attention to the development of specific educational-deficit oriented and criterion-referenced instruments which will answer with greater precision the question of what the child needs to learn next. This emphasis, of course, brings the field of learning disabilities into very close or overlapping contact with general education and could contribute greatly to improvement of all instructional practices. Functional analysis is a powerful process for decisionmaking because with these procedures the educator is able to determine the functional variables of learning.

Recommendations

Specific recommendations are offered regarding interdisciplinary communication, referral procedures, tests, diagnosis of teaching procedures, and evaluation of the diagnostic process.

INTERDISCIPLINARY COMMUNICATION

Continuing clarification and improvement of communication and working relationships among the various disciplines involved in the assessment of children with learning disabilities are essential (Clements, 1967). Substantial progress has been made in recent years, but problems persist regarding terminology, referral strategies (as will be discussed below), report writing, and jurisdiction in certain decisionmaking situations.

It is recommended that cooperative, successful interdisciplinary teams be studied and the ground rules analyzed. A comparison of strategies used by successful teams and those attempted by less successful teams could help establish guidelines for the many agencies and settings now beginning to employ interdisciplinary groups.

It is recommended that thorough and careful evaluation of the currently prevalent conferences and institutes on interdisciplinary communication be undertaken and the results used in future planning of such conferences.

It is recommended that existing interdisciplinary differences and difficulties be acknowledged among the professional groups concerned to enable objective consideration and resolution.

REFERRAL PROCEDURES

Certain persistent problems occur regarding diagnostic referral of children with learning disabilities. Often the professional to whom the referral has been made has inadequate information regarding the nature of the information he is being asked to supply. "Why was this child referred here?" is a question too often raised after the child has been seen. A related difficulty is encountered when the agency making the referral inappropriately specifies the diagnostic procedure to be used. For example, a child is sometimes referred "for an EEG" or "for an ITPA," when in fact the choice of the instrument to be used to gain the requested information should be up to the professional to whom the referral has been made.

It is recommended that referrals be made in the form of specific questions, always stating explicitly the nature of the information requested. For example, appropriate referral questions might include "Can any medical steps be taken to reduce his so-called hyperactivity?" "What method of reading instruction should be attempted?" or "What can be done to increase his responsiveness to speech therapy?" It seems important always to focus the referral question as directly as possible on the primary purpose of diagnosis which is to facilitate planning of what is to be done for the child.

TESTS EMPLOYED IN EDUCATIONAL DIAGNOSIS

Some tests are used in the almost total absence of predictive validity data and sometimes with inadequate attention to reliability. A related problem is that of the efficiency-effectiveness ratio of instruments. Some diagnostic "batteries" are compiled and used with little systematic attention to increasing predictive efficiency. Since evaluative instruments are being published at an ever increasing rate it becomes more important that the consumer have access to objective data on statistical characteristics of the tests. The proliferation of tests also suggests a need for closer relationships between models of cognitive functioning and test derivation. One further problem regarding use of tests in diagnosis is that of economy in terms of money, time, and personnel. The manpower shortage in such key disciplines in the diagnosis of learning disabilities as school psychology necessitates further development of meaningful tests, both individual and group, which can be administered by the classroom teacher or aide. Within the diagnostic process as conducted by any one diagnostician, regardless of discipline, greater economy can usually be achieved by a continual focus on the question of what information about the child's functioning is being sought. Too often a test is given because "we always give it" or because "we thought it might show something." This is not to say there is no place for exploratory diagnosis, but rather that the tests should be carefully selected for that purpose when that is the intent. However, the diagnostic information being sought is usually quite specific, e.g., are the child's auditory perceptual skills adequately developed to begin phonic instruction, and can often be obtained more efficiently than is currently done.

It is recommended that greater attention be given to the careful evaluation of tests already in use and those being developed.

It is recommended that greater attention be given to the role of models of cognitive functioning in the development and selection of test instruments.

It is recommended that greater emphasis be put on the development and use of criterion-referenced, task-specific tests and behavioral checklists to be administered by classroom teachers.

It is recommended that the use of standard batteries for individual diagnostic purposes be carefully evaluated and consideration given to greater use of an individualized "branching" type of diagnosis.

DIAGNOSTIC APPROACH TO TEACHING PROCESSES

A primary responsibility of educators concerned with learning disabilities is to direct major efforts toward prevention of disabilities whenever possible. An important part of this effort must be toward seeking increasingly better instruction for all children and toward accurate evaluation of the effects of this instruction on child performance.

It is recommended that diagnostic models now employed in the diagnosis of learning processes be used in the development of diagnostic approaches to the teaching processes. The purpose of diagnosing the teaching process would be to suggest ways to improve it.

EVALUATION OF DIAGNOSTIC PROCESSES

This report has described briefly some diagnostic procedures derived from cognitive models and from a functional approach to behavior. Diagnostic teaching (Kleffner, 1962) has not been dealt with as explicitly as many would wish. The procedures used in these three approaches are similar and even indistinguishable in many ways, but there are also large areas of important difference among them.

It is recommended that the efficacy of diagnosis itself be evaluated critically and that the several approaches to diagnosis should be systematically compared and contrasted. The role of periodic reevaluation of children's responses to remediation should also be systematically explored.

OTHER ISSUES

At the present time some rather complex and confusing relationships exist among definition, incidence, identification procedures, and test instruments employed. Incidence is clearly a function of definition; operational definitions are sometimes functions of identification procedures; the identification procedures may be related to the availability and characteristics of tests; and the development of tests is partially a function of definitions in use.

It is recommended that continuing efforts be directed toward clarification of definition, incidence, identification, and their relationships.

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Appendix I

Tests Used in Identification and Evaluation of Learning Disorders

The following tests include most of the widely used assessment instruments in the field of learning disorders. It is not, however, a comprehensive or exhaustive list. Those tests marked with an asterisk (*) were the most frequently mentioned instruments in an informal survey in which 43 professional persons responded regarding the tests they used or recommended in diagnosing learning disorders (Fertman, 1967).[1]

The tests are organized according to the following general headings:

I. INTELLIGENCE TESTS
    A. Global
    B. Verbal and/or Vocabulary
    C. Visuo-Motor (Performance)
II. PERCEPTUAL TESTS—Visuo-Motor
III. ACADEMIC ACHIEVEMENT AND DIAGNOSTIC TESTS
    A. Reading
    B. Spelling and Arithmetic
IV. DIAGNOSTIC LANGUAGE TESTS
V. SCREENING AND READINESS TESTS
VI. SOCIAL COMPETENCE TESTS

I. INTELLIGENCE TESTS

A. Global

Stanford-Binet Intelligence Scale: Combined L and M Form: Third revision. Houghton-Mifflin, 1960. Individually administered test of intelligence with IQ's for ages 2–0 through 18–0.

*Wechsler Intelligence Scale for Children (WISC). Psychological Corp., 1949. Individually administered test of intelligence providing separate verbal and performance scores with norms for ages 5–0 to 15–0.

A Quick Screening Scale of Mental Development. Psychometric Affiliates, 1963. Provides a rough estimate of a child's level of mental development with norms from 6 months to 10 years.

Merrill-Palmer Scale of Mental Tests. Harcourt, Brace & World, 1926–31. Individually administered test of general intelligence for young children.

Wechsler Preschool and Primary Scale of Intelligence (WPPSI). Psychological Corp., 1967. Individually administered test of intelligence providing separate verbal and performance scores with norms for ages 4–0 to 6–6 (overlapping the WISC in the age range 5–0 to 6–6).

Minnesota Preschool Scale. Teacher's College, Columbia University, Educational Test Bureau, 1940. Individually administered test of intelligence (similar in content to the Binet-type test) yielding verbal, nonverbal and total IQ from 18 months to 6 years.

Time Appreciation Test. Western Psychological Services (Buck, J. N.). Ten-minute intelligence test for children assessing only concepts of time.

Kent Series of Emergency Scales. Psychological Corp. Quick estimate of mental ability used to verify other testing in the age range of 5 years through adult.

B. Verbal and/or Vocabulary

Full Range Picture Vocabulary Test. Psychological Test Specialists (Ammons, R. B.), 1948. Individually administered nonverbal test of intelligence for ages 2–6 through adult.

*Peabody Picture Vocabulary Test (PPVT). American Guidance Service, 1959. Individually administered test of verbal intelligence estimated by measuring receptive vocabulary for ages 1–9 to 18–0.

Pictorial Test of Intelligence. Houghton-Mifflin (French, J. L.), 1964. Individually administered test of intelligence including 6 subtests with norms from 2–6 to 8–6.

Lorge-Thorndike Intelligence Tests. Houghton-Mifflin, 1954–62. Verbal test of intelligence.

C. Visuo-Motor (Performance)

Columbia Mental Maturity Scale: Revised edition. Harcourt, Brace & World, 1959. Individually administered test of intelligence requiring no verbal responses and minimizing motor responses; heavily weighted with visual discrimination and concept development for mental ages 3–0 to 10–0.

*Draw-A-Man Test. World Book Co. (Goodenough, Florence), 1926. Quick estimate of intelligence that can be used clinically to make assessments of personality and body image factors for ages 3–3 to 13–0.

Raven Progressive Matrices. Psychological Corp., 1938; 1947. Nonverbal test series designed to aid in assessing mental ability in solving problems presented in abstract figures and designs for ages 5–0 to 11–0 (1938) and mentally retarded adults (1947).

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[1] Joan C. Fertman. Personal Communication. May 1967.

Leiter International Performance Scale. Western Psychological Services, 1948. Individually administered nonverbal test of intelligence for ages 2–0 through adult.

Arthur Point Scale of Performance Tests, Revised form II. Psychological Corp., 1943. Individually administered nonlanguage performance scale for measuring intelligence for ages 4–0 to adult.

II. PERCEPTUAL TESTS—Visuo-Motor

Left Right Discrimination and Finger Localization. Hoeber-Harper (Benton, A. L.), 1959. This book includes research, reviews, methods of administration and norms from 6–0 to 9–0 for the tests of left-right discrimination and finger localization.

Harris Tests of Lateral Dominance. Psychological Corp., 1955. The manual of examining procedures brings together a number of easy-to-administer tests of lateral dominance including measures of eye, hand, and foot dominance for ages 7–0 to adult.

Memory-for-Designs Test. Psychological Test Specialists (Graham, F. K. and Kendall, Barbara S.), 1960. Test of visual memory.

*Benton Revised Visual Retention Test. Psychological Corp., 1955. Individually administered test designed to assess memory, perception, and visual-motor functions for ages 8–0 to adult.

Beery-Buktenica Visual-Motor Integration Test. Follett Publishing Co., 1967. Tests visual-motor integration through geometric form copying for ages 1–9 to 15–11 with separate norms for males and females.

*Frostig Developmental Tests of Visual Perception. Consulting Psychologists Press, 1961. Test of visual perception including 4 subtests for ages 3–0 to 10+.

*Bender Visual Motor Gestalt Test for Children. Western Psychological Services, 1962. Individually administered test of form copying with the score yielding both quantitative and qualitative assessment for ages 5–0 and 10–0.

Lincoln-Oseretsky Motor Development Scale. Western Psychological Services, 1955. Individually administered test measuring a wide range of motor skills, eye-hand coordination, etc., for ages 6–0 to 14–0 with separate norms for males and females.

*Purdue Perceptual-Motor Survey. Charles E. Merrill (Roach, E. G. and Kephart, N. C.), 1966. Individually administered survey providing an indication of the child's level of perceptual-motor development recommended for grades 1 through 4.

Minnesota Percepto-Diagnostic Test. Western Psychological Services, 1963. Individually administered test using Gestalt designs scored for degrees of rotation for children and adults; designed to detect type of reading disability and/or emotional disorder.

Ayres Space Test. Western Psychological Services, 1962. Performance test for children and adults with visual perception impairment with normative data provided for ages 3–0 to 10–0.

Road Map Test of Direction Sense. Western Psychological Services (Money, J.). Measures ability to orient to right or left, toward and away, and apply to two-dimensional plane for ages 7–0 to 18–0.

III. ACADEMIC ACHIEVEMENT AND DIAGNOSTIC TESTS

A. Reading

Gates Primary Reading. Western Psychological Services, 1958. Group tests of word recognition, sentence reading, and paragraph reading for grades 1 and 2.

Gates Advanced Primary. Western Psychological Services, 1958. Group tests of word recognition and paragraph reading for grades 2 and 3.

*Gates Reading Survey. Western Psychological Services, 1958. Group test including word knowledge, comprehension, and speed for grades 3 to 10.

Gray Oral Reading Test. Bobbs-Merrill, 1963. Individually administered reading test that is a useful supplement to silent reading tests for grades 1 to 12.

Gilmore Oral Reading Test. Harcourt, Brace & World. Ten graded paragraphs yielding 3 scores—accuracy, comprehension, and rate for grades 1 to 8.

Durrell Analysis of Reading Difficulty. Harcourt, Brace & World, 1955. Reading tests yielding an analysis at *how* the child reads and where he has difficulty for grades 1.5 to 6.5.

Spache Diagnostic Reading Scales. California Test Bureau, 1963. Battery of interdependent tests measuring specific components of reading ability from grades 1 to 8.

Roswell-Chall Diagnostic Reading Test of Word Analysis Skills. Essay Press, 1959. Tests child's knowledge of letter sounds, their combinations into words, and the ability to apply phonic rules for grades 2 to 4 (informal).

Roswell-Chall Auditory Blending Test. Essay Press, 1963. Test of sound blending for grades 1 to 5+ (informal).

Botel Reading Inventory. Follett Publishing Co. Three tests evaluating word recognition, word opposites and phonics.

Monroe Diagnostic Reading Tests and Supplementary Tests. C. H. Stoelting Co. Reading test battery consisting of any silent reading comprehension test, Gray Oral, Iota Word Recognition, Word Discrimination Test, and supplementary diagnostic tests.

McKee Inventory of Phonetic Skill. Houghton-Mifflin. Reading test measuring phonic skill.

A Quick Phonics Readiness Check for Retarded Readers. Schach, Vita G. Elementary English, 1962, 39, 584–586. Includes tests of auditory discrimination, sound blending, and auditory memory (very informal).

Learning Methods Test. The Mills Center, 1512 E. Broward, Fort Lauderdale, Fla., 1955. Designed to aid the remedial reading teacher in determining the student's ability to learn new words by four different teaching methods.

Dolch Basic Sight Vocabulary Test. Garrard Press.

Phonics Knowledge Survey. Harcourt, Brace & World (Durkin, Delores, and Meshover, L.), 1964. Phonics test to be administered to teachers.

Durrell-Sullivan Reading Capacity and Achievement Tests. Harcourt, Brace & World. Two parallel tests at each level reveal discrepancies between understanding of spoken language and understanding of the printed word for grades 2.5 to 6.0.

Doren Diagnostic Reading Test. American Guidance Service (Doren, Margaret), 1956. Group test of word recognition skills.

B. Spelling and Arithmetic

Buswell-John Diagnostic Test for Fundamental Processes in Arithmetic. Bobbs-Merrill. Individual test in which child works aloud to determine *how* answers are obtained.

Wide Range Achievement Test, revised edition. Psychological Corp. (Jastek, J. and Bijou, S.), 1965. Short test of oral word reading, spelling and arithmetic achievement with norms from kindergarten through college.

Diagnostic and Remedial Manual. Teacher's College, Columbia University, Bureau of Publications, 1940. Individual Diagnostic Program including 9 tests for grades 1.0 to 6.0.

Lincoln Primary Spelling Test. Educational Records Bureau, 1960–62. Three distinct, but overlapping, levels of spelling words so that the same test with different words can be used with children of independent schools (grades 2 to 4) and those of public schools (grades 2 to 5).

IV. DIAGNOSTIC LANGUAGE TESTS

Parsons Language Sample. Spradlin, J. E. J. Speech & Hearing Dis., Monograph Supplement No. 10, January, 1963, 8–31, 81–91. Individually administered test of language, including 7 subtests that sample language behavior according to a Skinnerian model.

Basic Concept Inventory. Follett Publishing Co. (Engelmann, S.), 1967. Based on an "educational deficit" rather than "diagnostic-remedial" approach to language deficiencies in children. Suitable for preschool and primary children or others with severe receptive language difficulty. May be used with culturally disadvantaged and auditorily impaired.

*Illinois Test of Psycholinguistic Abilities. University of Illinois Press (Kirk, S. A. and McCarthy, J. J.), 1961. Individually administered test of language, including 9 subtests with language ages from 2–0 to 9–6 (now being revised).

Verbal Language Development Scale. Western Psychological Services (Mecham, M. J.), 1959. Measures language age; expansion of Vineland Social Maturity Scale for ages infant to 15 years.

Orzeck Aphasia Evaluation. Western Psychological Services, 1964. Comprehensive evaluation of apraxia, agnosia, and sensory suppression.

*Auditory Discrimination Test. Language Research Associates (Wepman, J. M.), 1958. Individually administered test of auditory discrimination ability for speech sounds in single words for ages 5–0 to 8–0. Requires concepts of same and different.

Examining for Aphasia, Second Edition. Psychological Corp. (Eisenson, J.). Basic standardized procedure for systematic exploration of the language functions of aphasics for use with adolescents and adults.

Templin-Darley Screening and Diagnostic Tests for Articulation. Bureau of Educational Research and Service, 1960. Diagnostic and screening tests of articulation for ages 3–0 to 8–0.

Halstead-Wepman Aphasia Screening Test. J. Speech & Hearing Dis., 14:9, 1949. Useful in testing for verbal communication disorders.

V. READINESS AND SCREENING TESTS

Screening Tests for Identifying Children with Specific Language Disability. Educators Publishing Service (Slingerland, Beth H.), 1962. Three sets of screening tests to detect symptoms of possible specific language disability in average children in the primary grades.

The Predictive Index. Harper & Row (De Hirsch, Katrina, Jansky, Jeanette J., and Langford, W. S.), 1966. A diagnostic test of potential reading disabilities comprised of 10 subjects to be given to kindergarteners.

Detroit Tests of Learning Aptitude. Bobbs-Merrill. Battery of 19 tests with separate mental age norms and subtests separately for ages 4–0 to adult.

The Anton Brenner Gestalt Test of School Readiness. Western Psychological Services, 1964. Group test which assesses readiness for school.

Diagnostic Test to be administered by Teachers to Discover Potential Learning Difficulties of Children. (Peterson, Wretha). In J. Hellmuth (Ed.), Special Child in Century 21. Seattle: Special Child Publications, 1964, 271–273.

Dyslexia Schedule. (McLeod, J.). Bulletin of the Orton Society, 1966. Operational means of defining children with dyslexia.

The Valett Developmental Survey of Basic Learning Abilities. Consulting Psychologists Press, 1966. 229 developmental test items with educational relevance arranged sequentially under such headings as visual-motor coordination and concept development.

Kindergarten Evaluation of Learning Potential (KELP). McGraw-Hill (Wilson, J. A. R. and Robeck, Mildred C.), 1967. Helps teacher measure learning potential on the basis of classroom learning.

First Grade Screening Test. American Guidance Service (Pate, J. E. and Webb, W. W.), 1966. To identify first graders in need of special assistance to make sufficient progress to be ready for second grade.

Evanston Early Identification Scale. Follett Publishing Co. (Dillard, H. and Landsman, Myril), 1967. A quick, objective screening system for human figure drawing which yields classification as high, middle, or low risk. For use in kindergarten or early first grade.

VI. SOCIAL COMPETENCE TESTS

Progress Assessment Chart (Social-Emotional First Aid Teaching Sets) SEFA. N.A.M.H., 39 Queen Anne St., London W.1., England (Gunzburg, H. C.), 1963. For use with mentally retarded children providing a behavioral checklist of need for training in four main areas—self-help, communication, socialization, and occupation.

Caine-Levine Social Competency Scale. Consulting Psychologists Press, 1963. Behavioral rating scale of 44 items to estimate the social competence of trainable mentally retarded children.

Vineland Social Maturity Scale, revised. Psychological Corp. (Doll, E. A.), 1953. Binet-type age scale designed to measure the successive stages of social competence from infancy to adult life.

Preschool Attainment Record. American Guidance Service (Doll, E. A.), 1966. Global appraisal of attainment of children ages 6 months to 7 years in ambulation, manipulation, rapport, communication, responsibility, information, ideation, creativity.

SECTION III

EDUCATION, ADMINISTRATION AND CLASSROOM PROCEDURES

Laura Lehtinen Rogan and Jean E. Lukens

The subcommittee on education undertook to survey existing instructional services in public schools and the operational framework for programs for those children defined as having Minimal Brain Dysfunction and Learning Disabilities by Task Force I.

INVESTIGATION OF CURRENT PRACTICES

The method of investigation was a questionnaire designed to be responded to by school administrators in charge of special programs and by teachers or therapists working with children identified as belonging within the above classification. The questionnaire consisted of four sections, three sections to be completed by the administrator and one section to be completed by the special teacher. The three sections of the questionnaire directed to the administrator were designed to obtain information relevant to several areas, specifically: legal category and nomenclature identifying the programs; the types of educational services provided; the administrative structure employed; eligibility criteria and diagnostic procedures; and the extent of the services. The fourth section, directed to the teacher, was planned to survey actual practices and procedures in the special classroom and/or in the other teaching services provided. The latter are subsequently referred to as nonclass services.

As an initial step, the State Departments of Education in the 50 States were contacted requesting the names of all local school districts providing in any way for children with minimal brain dysfunction and learning disabilities. From the program directories and listings supplied by the education departments the names of the local school administrators were obtained. A total of 600 complete questionnaires were sent. A return postcard was enclosed for the administrator to request additional copies of section IV (for the teacher) in order to obtain as complete a survey in his district as possible. A total of 957 copies of section IV were mailed. A total of 305 returns (50 percent) of sections I, II, and III (for the administrator) were received. Of section IV (for the teacher) 762 (76 percent) were returned.

Analysis of the data was based on the returns received by May 1, 1967, which represented 37 States. This sample consisted of 246 of sections I, II, and III and 661 of section IV of the questionnaire. Replies in the form of a letter or a completed questionnaire were received from 50 States and the District of Columbia. Eight States reported having no programs. Of the six States that responded after the deadline, one reported a classification of Educationally Handicapped with five districts serving 60 children. One had broad legislation and reported serving 25 children in two districts. Four had no specific legislation but 15 local districts were nevertheless serving more than 156 children with learning problems.

NOMENCLATURE

As was to be anticipated, considerable variation was found to exist in the terminology by which the children in question were identified in the various programs throughout the country and by which the programs themselves were identified. The term "minimal brain dysfunction" selected by Task Force I as most clearly descriptive of the syndrome of constitutionally based learning disabilities was used in the survey questionnaire. This term failed to communicate accurately in many instances, perhaps because of a lack of clarity in definition, perhaps because the responsibility of the school toward children with learning problems has traditionally been to provide education regardless of the etiology of the child's problem, and the diagnostic classification was viewed as secondary to the practical problem of education. Some respondents indicated that, as used in their programs, the term "learning disabilities" was more inclusive than the term "minimal brain dysfunction" and applied to emotionally disturbed children and children with undiagnosed learning disabilities as well as to children with neurological impairment.

It seemed clear from the replies and accompanying letters that many school systems do in fact program for children who are not mentally retarded but who are disabled in learning. The range of services mentioned extends from consultants to the classroom teacher or from help by specialists in educational remediation such as remedial reading experts to teachers in selfcontained classrooms. The replies reflected nationwide awareness of a possible relationship between minimal brain damage and learning difficulties, but separate educational programing based on medical diagnosis of central nervous system function was not necessarily in effect.

The terms used to identify special classes for children with learning disabilities were, in the order of frequency found in the replies:

	Percent
Educationally Handicapped	19.5
Learning Disabilities	19.5
Perceptually Handicapped	14.9
Brain Injured	9.2
Minimal Brain Damage	5.1
Special Learning Disorders	3.8

In 28 percent of the replies some other term was in use. Among these were Instructional Center, Emotionally Handicapped, Neurologically Impaired, Specific Learning Disabilities, Maladjusted, Socially Maladjusted, Educationally Maladjusted, Special Methods. Learning Adjustment, Special Achievement, Extreme Learning Problems, Extreme Language Disorder, Severe Neurological Impairment, Mild Neurological Impairment, Minimal Brain Injury, Behavior Problem Class, Immigrant Program, and Itinerant Program.

The terms by which the classes were designated did not necessarily suggest the criteria for selection of the children. Of the 7,660 children included in the sample, 4,365 had a medical diagnosis of neurological dysfunction, yet these children were not solely in programs whose names conveyed a medical connotation.

The various names for special classes seemed to fall into several groups as follows:

According to adminitrative plan
  Instructional Center
  Itinerant Program
  Immigrant Program
With an educational focus
  Educationally Handicapped
  Educationally Maladjusted
  Learning Adjustment Class
  Special Achievement
  Special Methods
With an educational focus but with acknowledgment of some specificity of the problem
  Learning Disabilities
  Special Learning Disorders
  Specific Learning Disabilities
  Extreme Learning Problems
  Special Learning Difficulties
With a social adjustment focus
  Emotionally Handicapped
  Maladjusted
  Socially Maladjusted
  Behavior Problem Class
  Adjustment Class Program
With a medicopsychological orientation
  Perceptual Development Program
  Perceptually Handicapped
  Brain Injured
  Minimal Brain Damage
  Neurologically Impaired
  Neurologically Handicapped
  Extreme Language Disorder
  Severe Neurological Impairment
  Mild Neurological Impairment
  Minimal Brain Injury
  Minimal Brain Dysfunction

Nonclass services, i.e., services provided to children individually or in twos and threes, were referred to with equally diverse names as these classes. In all, 36 other terms identifying nonclass programs were mentioned. Many of these terms reflected the same kind of orientation as seen in the names by which the class programs were known, e.g., Resource Room, Home Teaching, Educational Handicap, Remedial Developmental, Individual Instruction for Disability Groups, Teachers of Extreme Learning Problems, Adjustment Teacher, Teacher Advisement Adjusted Program. Others suggested a somewhat different plan or approach in dealing with the learning disability problem. Many terms referred to a specialist in some other field (Hearing Specialist, Vision Specialist, Speech Therapy, Remedial Reading Guidance Service) or a new specialist whose function was to assist or supplement the work of the classroom teacher (Auxiliary Teacher, Supplemental Instructor, Supportive Tutorial, Teachers Aid Program). One referred to the program as for physically handicapped children with perceptual problems, and one described it as In-Service with Regular Teachers. No names with a medicopsychological quality such as were in use to identify class programs, e.g., minimal brain injury, perceptually handicapped, were reported. Replies to the section on nonclass services suggested that in many instances the children with learning disabilities were being served by the regular teacher with the assistance of an aide or by existing specialists or resources which were being used in a more comprehensive way. Some nonclass services seemed to have been specifically designed as new programs in special education for the learning disability group.

LEGAL TERMINOLOGY

The dilemma of labeling the services for children with learning problems is also reflected in the legal classifications of programs within the school structure. Programs are classified legally for purposes of efficiency in administration, financing, and supervision. In order to operate, therefore, services to children with learning disabilities had to be fitted into existing legal categories or a new classification had to be created. Of the 241 returns on section I, 212 administrators responded to the question on legal terminology. The replies indicated that 72 (34 percent) of the programs for children with learning disabilities were classified as programs for the physically handicapped, 66 (31 percent) were classified as educationally handicapped and eight (4 percent) as emotionally disturbed. The remaining 66 programs were reported to be classified in more than one legal category or in a new category. Examples of new categories were neurologically impaired, brain-injured, perceptually handicapped, learning disorders, multiple handicap, and varying disabilities.

FINANCIAL REIMBURSEMENT

Financial reimbursement for the programs was reported to come mainly from special education and general education funds. Sixty-five (27 percent) of the respondents indicated that State and local special education funds were the source of financing, and 48 (20 percent) indicated that programs were financed from general education funds. Seventeen (7 percent) received support from both. Some districts reported special educational programs being funded by Federal funds, private foundations, or special taxes.

GOALS

Almost the entire number of respondents, 209 (87 percent) indicated that the goal of the special program was the integration of the special class children into regular classes. A few—six in all—indicated that such was not the goal, and two indicated that both the goal of return to regular class and of remaining in the special class were held. Many respondents qualified the return to regular class as being gradual or when reevaluation indicated that the child was ready.

ABILITY LEVELS

The term "minimal brain dysfunction" in itself connotes a disruption in the expected normal functioning of the central nervous system but the greater number of school districts of the 236 responding indicated that their services, whether classes or other programs, were intended to serve children with tested intelligence quotients ranging from 80 on upward. Forty replied that children with IQ's from 70 to 79 were accepted into their programs. A relatively large number of districts reflected the difficulty of establishing definitive and reliable classification of children on the basis of present test instruments by their indicated practice of accepting children into their programs with "potentially normal intelligence" or with "IQ's of 70 to 89 with potentially higher ability."

IQ range	Classes	Other services	Both services
70 to 79	40	7	12
80 to 89	54	19	37
90 to 110	65	28	71
110 and over	42	24	46
Potentially normal	59	17	43
IQ 70 to 89 with normal potential	42	13	21

An individual intelligence test was required to determine the child's eligibility for special classes more often than for nonclass services. Of the 236 districts reporting, the Stanford-Binet was used by 121 to establish eligibility for special classes and the Wechsler Intelligence Scale for Children by 144. Only 12 districts, however, used the Stanford-Binet to determine eligibility for nonclass services, while 15 employed the Wechsler Intelligence Scale for Children. Sixty-three reported using the Stanford-Binet, and 67 indicated that the Wechsler Intelligence Scale for Children was employed to determine eligibility for both types of services. Thirty-three other test instruments were mentioned as used to obtain additional psychoeducational information. These could be grouped as tests of general ability (group and individual), language development, visual-perceptual organization, gross motor development, memory, personality, and academic achievement.

MEDICAL ASSESSMENT

The terminology used to identify the programs, i.e., brain-injured, neurologically impaired, perceptually handicapped, etc., did not indicate whether medical diagnosis was a prerequisite for enrollment in the program. Of the total number of programs reporting, 64 percent stated that a medical assessment of the child's neurological status was required for admission to one or other of the special programs. This included some programs labeled perceptually handicapped or educationally handicapped. Only 12 percent required that medically clear-cut neurological signs be present while 45 percent accepted the diagnostic validity of soft neurological signs.

The questionable usefulness to the schools of a medical diagnosis as a basis for instructional grouping was perhaps suggested by the information that 49 percent of the districts did not require a medical assessment of the child's neurological status but that placement in either type of special program could be decided on the basis of learning and/or behavior problems. However, the finding that 64 percent of the reporting districts do require or usually obtain such information suggests that schools do regard neurological studies as contributory to an understanding of the child's failure to learn according to normal expectations.

OTHER DIAGNOSTIC INFORMATION

Judging by the frequency with which measures of visuo-motor functioning were mentioned as required or usually included in the diagnostic procedure for admission to the special programs, this aspect of child development was regarded as important. Social and environmental data with respect to the child's home and family were also reported as a very important part of the diagnostic information required. More than three-fourths of the respondents reported that a personality study was required or usually obtained as part of the procedure for determining eligibility for the special program. One-third indicated that such information was obtained through a psychiatric study. Speech and language evaluation was mentioned by two-thirds of the respondents as forming part of the usual diagnostic study, and health and developmental history was reported with the same frequency.

Oddly enough not all of the districts reported the assessment of the child's educational level as required or usually obtained in determining placement in the special program. It is possible that the question posed in the questionnaire was unclear or that such assessment ordinarily formed part of a more inclusive psychological evaluation and was not reported separately.

The replies indicated that among the 236 districts responding, practice regarding the eligibility for learning disability classes of children with "primary personality and emotional problems" was about evenly divided. Forty-five indicated that children presenting such problems were accepted into classes designated for children with learning disabilities, and 40 percent indicated that they were ineligible. Children with emotional problems judged to be in reaction to their primary learning deficits were admissible to the special classes according to 77 percent of the replies. Hyperactivity as reported by approximately two-thirds of the respondents did not disqualify a child.

The complexity of the diagnostic and educational problem is possibly reflected in the finding that in most systems reporting, the responsibility for placing children in the special programs rests most often with a committee. This is variously designated as a screening or evaluation committee and is composed of representatives from the school structure who have an administrative or supervisory function and a variety of others with special skills. The most typical multidisciplinary committee is composed of any of the following staff and specialists listed in the order of frequency with which the members were mentioned: School administrator and/or special services administrator, psychologist, teacher, medical specialist (pediatrician, neurologist, psychiatrist), speech therapist, social worker, reading specialist, school nurse. Seven districts reported the existence of a cooperative arrangement for evaluation purposes with a local medical center, clinic, mental health center or hospital.

PRACTICES AND PROCEDURES IN THE CLASSROOM

Section IV of the questionnaire was directed to teachers and requested specific information on group composition, characteristics of the children, management approaches and curriculum. A total of 661 teachers of either classroom or nonclass services from 241 school districts returned the questionnaire. Teachers of nonclass services indicated their positions among others mentioned as auxiliary teacher, elementary counselor, speech therapist, and teacher of extreme reading problems. Since not all of the questions applied to all situations, some of the questions were unanswered. Nevertheless, questionnaire data were available for most of the areas of inquiry from 646 teachers serving 7,660 children. The data from this sample indicate the presence of one teacher, on an average, for 12.08 pupils.

SIZE OF CLASS OR CASELOAD

The largest number of teachers (299) reported having eight to 10 children in their class or caseload, and 136 reported having 11 to 15 children. Teachers serving eight to 15 children comprise 67 percent of the sample. Forty reported having fewer than five children. Many reported more than 15, and some reported having a 1 to 1 relationship for short periods of time during the day.

ABILITY LEVELS

Teachers reported the intelligence levels of children actually enrolled in their groups to range from the borderline retarded to above average classifications. Many reported that the slower children must be judged to have a potential for normal intelligence. None reported having severely handicapped children.

CHRONOLOGICAL AGES

The range of chronological ages of children served in the special programs was reported to extend from 5 to 19 years, or from kindergarten through high school with the greater concentration of services existing for the 6- to 12-year-old age group. The services in the junior and senior high schools suggest tutorial or small group remedial programs rather than special class placement for the 13- to 18-year-old age group.

HOURS OF SPECIAL TEACHING

The majority of teachers (58 percent, 377 of 651 responding) reported that the length of time spent during the day with their pupils was essentially a full school day ranging from 4½ to 6 hours in length. Ninety-two teachers (14 percent) indicated that they offer less than 1 hour per day of special service to each child. Most of the replies indicated that some children in a group spend a portion of the school day, ranging from one-half hour to more than 3 hours, in the regular classroom. Almost one-half of the reports (40 percent) indicated that children in a group might spend half of the school day or more in the regular classroom.

ADDITIONAL THERAPIES

Speech therapy is received by almost one-fourth (23 percent) or 1,749 children enrolled in the special programs and, according to the estimates of the teachers reporting, an additional 615 children or 8 percent should be but are not receiving such service.

Teachers report that 1,213 children (16 percent) receive counseling or psychotherapy from some professional other than the teacher herself and estimate that as many as 1,543 (20 percent) are in need of further help in this area and are not receiving it. While the teacher is not necessarily the person who might best judge the child's need or capacity to benefit from psychotherapy or counseling, these figures do suggest that teachers feel that as many as one-third of their group have emotional problems of such a degree that they would welcome assistance in dealing with them. A considerable number of children, 2,578 (31 percent) were known to be receiving medication.

TEACHER ASSISTANCE

Teachers reported that consultant help was available to them from the following sources, listed in the order of frequency with which they were mentioned: Psychologist (80 percent), speech therapist (78 percent), coordinator of the program (66 percent), social worker (38 percent), and psychiatrist (21 percent). Remedial reading specialists, school principals, curriculum directors, and clinic (diagnostic and health) personnel were also named as functioning in a consultant role to the teacher.

One-fourth (25 percent) or 167 of the teachers reported having the services of an assistant or aide who might help in the classroom in a variety of ways or in the preparation of materials. Of those teachers who did not have an aide, 258 (40 percent) felt that an assistant was needed in order to serve the children more adequately. The kinds of assistance received by the teachers are discussed in the section on curriculum.

CLASSROOM MANAGEMENT

Almost three-fourths (71 percent) or 451 of the 637 teachers reporting indicated that they maintained a classroom which was either highly structured or quite structured. Forty-nine (11 percent) reported that their teaching unit was conducted much like a regular class, while 74 (16 percent) stated that their classrooms had a permissive atmosphere.

A large number of teachers (527 or 80 percent) mentioned that the small class size was a factor in reducing stimulation, and 479 (72 percent) indicated that they used room arrangement for this purpose. A little less than half, 304 (46 percent) reported that they found cubicles advantageous. Others listed study carrells, blinders between desks, glassed-in offices, isolated study space, screens, frosted windows, no windows, curtains, draw-drapes, minimized room decorations, rug or carpet, limitations on equipment in evidence, and classroom location within the building as important factors in reducing stimuli. Order, consistency, routine, presentation of materials, reinforcement therapy, child adjustment, and the 1 to 1 relationship were mentioned by others.

Fifty-four percent (354) of the teachers reported that although they had classes, their work with the children was chiefly individual. Three percent (19) of the teachers reported they taught primarily through group work and 34 percent (226) felt they used both individual and group teaching approaches equally.

CURRICULUM

Teachers were asked to indicate those curriculum areas which comprise the programs for the children in their groups. They were also asked to designate the person or service responsible for teaching the various curriculum areas.

Academic skill development.—(Language arts.) The general orientation of the special programs toward cognitive and academic skills development is reflected in the finding that 512 (77 percent) of the 661 teachers responding indicated that developing or improving the child's skills in reading, spelling, writing, grammar, and arithmetic formed a major part of the curriculum of the special program. Four hundred and three (63 percent) reported this area of learning was the responsibility of the special teacher, 15 (2 percent) indicated the regular classroom teacher carried this responsibility, and 102 (16 percent) indicated the special teacher and the regular classroom teacher shared this teaching.

Content areas.—(Social studies, science, etc.) Learning of content was mentioned as forming a major part of the curriculum by only 15 percent (99) of the teachers responding. In most instances it is taken up as needed. Three hundred and thirty-three (57 percent) of the special teachers give some emphasis to content. Sixty-four (11 percent) of the teachers replied that it is the regular classroom teacher who carries the responsibility for teaching this subject matter. A variety of means for teaching content-laden material was reported, including the use of services of the librarian or other special teachers (science and social studies), visual aids, educational television, and field trips.

Oral communication skills.—These skills were indicated as comprising an important part of the curriculum by 621 teachers and a major part of the curriculum by 346 (52 percent). Most of the special teachers (361, 58 percent) were responsible for the teaching in this area of development. Resource teachers (11) and speech therapists (15) were mentioned as carrying this responsibility in some of the programs. Thirty-five teachers indicated the responsibility was carried jointly by the special teacher and the regular classroom teacher, and 96 reported the responsibility shared by the special teacher and the speech therapist.

Gross motor development.—Instruction in this area was reported to be part of the curriculum by 596 teachers and of major importance by 37 percent (243). Three hundred and thirteen (52 percent) of the special teachers assumed the responsibility for conducting a program intended to improve the child's gross motor skills. Sixty-three replies specified the physical education teacher as the one responsible for this curriculum area, and 94 specified the responsibility shared by the special class teacher and the physical education instructor. In improving the child's development in this area, a great many other persons with widely varying skills and competencies were mentioned. Examples of some who assisted in this area were volunteers under guidance, student teachers and interns under direction, aides, parents, and assistant teachers. In all, over a hundred categories of assistants were listed including an optometrist, physical therapist, motor therapist, occupational therapist, music teacher, and fifth grade helpers.

Fine visuo-motor skills.—Development of these skills was listed as part of the curriculum by 591 teachers and specified as a major part of the curriculum by 56 percent (372). The special class teacher was named as the one in charge of this area in 453 (75 percent) of the reports. The regular classroom teacher was mentioned as being responsible in 15 replies. Here again various categories of personnel were mentioned as sharing this training responsibility. The physical therapist, occupational therapist, tutor, and resource teacher were all listed. In most instances several persons were named as sharing the teaching of these skills. According to the listing of participating personnel, the special teacher and some assistant, variously called aide, assistant teacher, parent, volunteer, art teacher, and visual perceptual specialist very often carried this part of the curriculum responsibility.

Social skills.—(Group living.) While this might not be defined as a formal curriculum area, it was regarded as important by 596 teachers and as a major area by 34 percent. The special teacher was listed as responsible 426 times (70 percent), the regular class teacher 37 times. Other personnel in various combinations were listed many times, including a speech teacher, volunteers, counselor, aide, intern, homemaking teacher, music teacher, and psychologist.

TRENDS

Awareness of the problem presented by essentially normal children who do not learn for one reason or another and who need special programing is nationwide. Many States already have legislation recognizing the special needs of these children. In other States programs have developed under local initiative and are financed from funds outside the special education budget. Programs have tended to be organized in areas where administrative flexibility and resources of personnel, funds and community services have been favorable. Referral for learning problems is accepted as a valid basis for individual diagnostic study and possible special educational programing.

Terminology both in reference to identifying the child with a learning disability as well as the programs developed in answer to his needs is far from being universally accepted. At least 30 different terms are currently in use which are variants of "educationally handicapped," "learning disability," "perceptually handicapped," "minimal brain damage." The terms and variants in most common use favor an educational rather than a medical connotation, perhaps suggesting some specificity or developmental origin to the learning problem.

More than half of the children presently being served are reported to have a medically established diagnosis of neurological dysfunction. This percentage in all probability accurately reflects neither the number of learning disability cases in which minimal cerebral dysfunction may be an etiological factor nor the number of children within existing programs whose learning failures can be causally related to nervous system dysfunction. Not all existing programs require medical diagnostic studies as an admissibility requirement.

To an unprecedented degree in education, the planning for children with learning disabilities is a multidisciplinary effort both from the standpoint of diagnosis and class assignment, as well as therapeutics. The professional specialities of psychology, medicine, speech and language therapy, social work, physical education and/or physical and occupational therapy supplement the work of the specialist in education. In his capacity as administrator the educator serves as coordinator of the information and services of other disciplines. The teacher functions as the central figure responsible for the child's learning, not only through specific educational programing but also in implementing the recommendations of other specialists.

At the present time, the great majority of programs are regarded as short term or remedial in nature, anticipating a termination point at which time the children will be absorbed into the regular classes with no further need for special planning. The reported upper age limit of 19 years may suggest that many cases were identified very late in their school careers. On the other hand it may represent recognition of a factor of persistence or chronicity to the problem which manifests itself in changing ways as the child grows and as school demands change. The present programs are designed for children in the normal intellectual range, broadly interpreted. No information was obtained on what may or may not be done for children falling below this demarcation line who are classified as retarded or borderline in intelligence. Recognition of the diagnostic complexities and the persisting enigmas of child development seems to be reflected in the willingness to permit placement of the child falling within the borderland of normalcy to be determined by his functioning within the special setting rather than on the basis of objective test results alone.

Clinical study as well as educational testing is considered essential for admissibility of children to special classes while remedial programs of a nonclass nature accept children for help with more isolated problems and without investigation of causal factors. A vast expansion of the child psychologist's armament has occurred to include a great variety of tests which contribute specific information to the diagnostic effort.

Practice is about evenly divided on the inclusion of the children with primary emotional problems in classes for children with learning disabilities. Teachers report a need for more consultation or therapeutic assistance in dealing with children who have emotional problems. Tutorial or small group remedial help is preferred over the self-contained classroom for the adolescent age group. Parallel to the organization of the special teaching programs on a short-term basis is the reported finding that most of the children involved spend varying amounts of their school day in the regular classroom.

The involvement of a large staff of ancillary personnel from within the school faculty or on a volunteer or training basis from outside the school is common in order to provide the many therapies required. This appears to reflect the multifaceted nature of the syndrome of minimal cerebral dysfunction as the therapies range over any of the systems—motor, perceptual, cognitive, language, social, and emotional—which may be involved.

Classroom procedures reflect recognition of the uniqueness of individual learning patterns as seen in the teachers' practice of individual instruction. Environmental modifications and special curriculum adjustments were reported by the majority. There appears to be greater awareness and perhaps understanding of various areas of child development and deficits, with an orientation toward remediation, rather than simple reduction of standards or reteaching at a slower pace.

Issues

CLARIFICATION OF TERMINOLOGY AND IDENTIFICATION OF SYNDROMES OF LEARNING DISABILITY

The present construct of learning disability is descriptive and suggests no etiological factors. Within this heterogeneous group are undoubtedly subgroups of syndromes related to differing etiologies, e.g., learning disability—minimal brain dysfunction. While etiological factors may or may not be related to educational programing, they are surely related to medical management of symptoms, parent understanding of the child and intrafamilial relationships, and perhaps vocational planning. The clinical and research efforts at clarification of diagnosis may not be the prime responsibility of the schools, but it deserves their full cooperation.

CLASS ASSIGNMENT OF CHILDREN WITH LEARNING DISABILITIES

Several choices within the school structure are available: Regular graded classroom, nongraded primary and elementary school, special class, remedial instruction in small groups or individual sessions, specialized instruction for learning disorders in small groups or indivdual sessions. Data are not available as to which kinds of plans are most effective for which types of children.

GROUPING OF CHILDREN WITH LEARNING DISABILITIES IN SPECIAL SERVICES

The question to be answered is: What should be the basis for placement? Should placement be based on (1) medical-psychological diagnosis, including etiology, (2) psychoeducational assessment, indicating areas of deficit, (3) achievement failures in specific areas of skill such as reading and arithmetic, or (4) social adjustment?

ADMINISTRATIVE ORGANIZATION

Is an individual or special class approach the most effective way to deal with learning and/or achievement deficiencies? Might not other arrangements such as nongraded elementary schools and flexible ability grouping benefit many children with relatively mild problems?

CURRICULUM CONSIDERATIONS

Is the curriculum for young children overweighted in certain directions, e.g., providing experiences and developing language, or would a good developmental curriculum provide more opportunities for developing gross motor, visual-perceptual and grapho-motor skills? Would such a curriculum serve to stimulate development in these areas in children with marginal problems without the need for individualized evaluation and special teaching except for severe cases?

KINDS OF INFORMATION ESSENTIAL TO PLANNING FOR THE EDUCATION OF CHILDREN WITH LEARNING DISABILITIES

Obtaining information is time-consuming and costly especially when the services of specialists are required. In placing children for optimum educational benefit, is it necessary to obtain a developmental history, family history, medical and neurological diagnosis, psychiatric diagnosis, psychological evaluation, educational evaluation, and evaluation of speech and motor development?

Psychological studies, depending upon time available and psychologist's training, are often either too limited or too detailed. What tests or observations are most relevant in differentiating learning-process problems from motivational problems? What are the relative roles of cognitive and effective factors in contributing to educational maladjustments? How significant a contributor is a unidimensional teaching approach which accepts individual differences in interests and talents but provides only a one-track approach to the acquisitions of scholastic skills?

INDIVIDUALIZED REMEDIAL METHODS

Failure to master basic academic skills such as reading, spelling, and arithmetic is the symptom which most often results in a child's being referred as a learning problem. Would more individualized remedial methods aimed specifically and directly at improving these skills benefit many children with learning problems without the necessity for a detailed psychoeducational assessment?

AGES FOR INDIVIDUAL CLINICAL TEACHING

Maturation rates are not the same for all children. Many apparent deficits in articulation, auditory perception, visuo-motor organization, and motor skills improve with maturation and general practice without the need for specific intervention. In the long run, would a developmental curriculum through 8 years of age be more effective for immature or slow developers than individual, corrective teaching? What are the ages at which the above-mentioned abilities typically mature?

PERSISTENCE OF THE DEFICITS

Do the deficits now being identified represent remediable deficits or will they persist throughout the child's school career as permanent deficiencies? If the deficits are permanent, then schools will need to plan for vastly expanded services into adolescence and for occupational guidance programs which recognize these limitations.

PERSONNEL TRAINING

In addition to development of the specialized skills of the learning disabilities teacher, understanding of the problem will need to be acquired by the administrator, the regular classroom teachers from kindergarten through high school, special teachers, and counselors since the children in question spend part of their day in the regular classrooms and ultimately may return to the regular classroom on a full-time basis.

Recommendations

Open lines of communication between professionals of the various disciplines working on the problems of diagnosis and therapeutics should be maintained and increased if possible. Programs are in their infancy, and innovation and experimentation at the local level should be encouraged in response to unique local circumstances as well as to challenge and check current procedures.

Because of the heterogeneity of the group now being identified as learning disabilities and because of the large numbers of children involved, a variety of good programs should be developed as resources in addition to special classes or other instructional services. Present trends in general education may help the children with a maturational lag and bring about earlier referral for the child with more severe problems.

Programs such as the following should be initiated or improved:

a. Good developmental kindergarten-primary programs with well-balanced curriculums providing for all aspects of early cognitive development (perceptual, visuo-motor, language, concepts);

b. Expansion of readiness testing for kindergarten entrance as a basis for flexible "maturity" groupings with specialized curriculums at the kindergarten level;

c. Transitional or extended readiness classes for children who show a lack of readiness for first grade;

d. Nongraded or flexibly graded primary programs permitting passage of the child from one level to another according to his developed capacity to deal with the instructional demands rather than chronological age; transitional classes leading into second or third grade as a partial solution for the school which retains its grade structure; specific, nonrepetitive curriculum in the transitional classes;

e. Regrouping within classes or within several classes for instruction in skills according to preferred learning modes, e.g., primarily auditory emphasis in reading (phonics) or visual (sight-word reading) for children with strengths in these areas;

f. Provision in later elementary grades (through regrouping) for teaching basic scholastic skills to children who for various reasons (illness, absence, immaturity, family mobility) have not mastered them at the normative age; teaching of phonics beyond the second and third grades;

g. Utilization of existing specialists through expansion of competencies for individual or small group help to children with learning disabilities; for example, extension of techniques and knowledge of remedial reading therapists and speech correctionists to include work with children of minimal brain dysfunction;

h. Development of learning laboratories for special skills such as library reference, study approaches, organization of material, especially in the upper elementary and high school levels.

Many further changes are recommended. A change in the philosophy and orientation of teachers of the educable mentally handicapped is necessary to allow more prescriptive teaching of the child with large discrepancies or irregularities of function at the EMH level. A change in the teacher training curriculum to include greater understanding of child development and techniques of teaching the "immature" child is also required. Further research on learning in early childhood relating to the improvement of instructional practices and prevention of disabilities is mandatory. There is a great lack of evidence for many of the educational practices now being adopted. More knowledge is required at all levels. Investigation into the effects of various procedures at different age levels, e.g., gross motor training for the older child, is also important. Further, research into maturation patterns in various areas of perception, fine motor dexterity, auditory and language skills is greatly needed. Since many of the children in question are not a segregated group but will spend a large part of the school day in regular classes, it is essential that all teaching staff develop an understanding of the learning disabilities problem. The accumulation of long range data is necessary in order to set realistic goals for the child and his parents. Adequate educational planning requires multidisciplinary interaction to handle the variety of children viewed as learning disabilities. A reorganization of the legal structure of special education which stresses degrees of learning as the basis for instructional classification in place of or in addition to etiology-based groupings is essential.

SECTION IV

PROFESSIONAL PREPARATION FOR THE EDUCATION OF CHILDREN WITH LEARNING DISABILITIES

Norris G. Haring, William R. Reid, and James D. Beaber

A cursory review of developments in the education of exceptional children reveals a gradual but continuous course of instructional refinements. The quest of special educators for obtaining more reliable information on the teaching-learning process has played a significant role in these developments. An even greater contribution to more effective education for children has come through the search for instructional procedures which would yield results with children who *have learning disabilities.*

These gains in instructional procedures have come about through (1) evaluation of the teaching-learning act, (2) precise specification of the skills and knowledge the teacher must acquire (performance criteria) to function effectively in the teaching-learning act, and (3) establishment of training programs designed to develop these skills and knowledge. The degrees of refinements visible in teacher research, training, and performance, especially, have become possible through refinement of evaluation procedures functional for the classroom, designed to evaluate the independent variables of the teaching-learning act (O'Leary and Becker, 1967; Nolen, Kunzlemann, and Haring, 1968; Bateman, 1964). Refinements also have become feasible through increased precision in specifying performance criteria. Statements of performance criteria have gradually been specified in terms of behaviors which can be directly evaluated. This evidence reveals that education is becoming more scientific (or more accurate) in its evaluation of methods designed to improve instructional procedures.

Specific developments which have contributed to increased precision in instruction are well exhibited by surveying the changes observable in research on teacher training, in the objectives and content of programs of professional preparation, in standards for accreditation and certification, and in the methodology of direct, systematic observation. It is a history of refinement in the:

1. Specification of the skills and knowledge teachers should have in order to teach effectively;
2. Measurement procedures designed to evaluate the effectiveness of training programs developing these skills and knowledge and designed to evaluate teacher effectiveness in application of these procedures to the classroom;
3. Research techniques designed to determine relevant independent variables of training programs, teacher performance, and child performance; and
4. Certification requirements as they have come to specify more precisely the skills teachers must exhibit.

All developments in education reflect evidence of forging this route (O'Leary and Becker, 1967; Gallagher, 1967; Quay, Werry, McQueen, and Sprague, 1966; Bateman, 1966; Cruickshank, Junkala, and Paul, 1967; Kirk, 1968). Advancements in educational research, training, and service have been and will be through refinements in instructional procedures.

RESEARCH IN PROFESSIONAL TRAINING

Professional training programs in learning disabilities, at least formally, are only a few years old; consequently, research does not specifically relate to evaluation of trainees, teachers, or training programs in this area. Research in teacher training from other areas of special education (Mackie and Williams, 1959; Blatt, 1966; Schwartz, 1967) and from general education (Medley and Mitzel, 1963; American Association of Colleges of Teacher Education, 1964; Gage and Unruh, 1967), however, provide very relevant considerations requisite to review and evaluation of current professional programs in learning disabilities.

Quite possibly the three most relevant features from the findings of research on teacher preparation are that (1) little effective research has been accomplished (Balow, 1966; Fargo and Haring, 1968), (2) specification of observable teacher behaviors is essential to any further refinements in teacher training, evaluation, and research, and (3) the refinements in direct observation and measurement of behavior in the classroom during the teaching-learning act are the most significant and promising developments to come from research thus far (Blatt, 1966; Wallen and Travers, 1963). The limited research that has been reported indicates that educators neither know what to teach the teacher nor how to evaluate her. Failure to identify what to teach stems from failure to identify responses a skillful teacher makes to facilitate learning. Such failure results largely from lack of direct observation and systematic recording of the ongoing activity during the teaching-learning act (Mackie and Williams, 1959; Wallen and Travers, 1963). With this status in mind, three issues arise for consideration in teacher training: (1) Specification of performance criteria defined in terms of observable teacher responses; (2) utilization of techniques for direct observation, recording and measurement of classroom behavior; and (3) measurement of child performance as the ultimate criterion of teacher effectiveness.

Techniques for accurate and reliable response data obtained from direct observation have become more and more refined. Research, however, exhibits that procedures for observing classroom behavior have not yet been utilized with enough precision in defining the dependent variable to yield accurate results for assessment of the independent variables of classroom performance (Medley and Mitzel, 1963). The use of direct observation procedures ". . . to obtain more valid, reliable measurement of differences in the typical behaviors which occur in different classrooms, or in different situations in the same classroom . . ." (Medley and Mitzel, 1963, p. 250) was originally introduced in the classroom to study teacher effectiveness (Horn, 1914). In order to obtain valid, reliable information, these procedures require the utilization not only of precise definitions of the dependent variable but also continuous, systematic measurement of the specified behavior under stable conditions. Medley and Mitzel underscore the necessity for behavior measurement through systematic observation, a procedure they specify as requiring observation of the behavior, recording of its occurrence immediately, and measurement of the behavior, from the record to enable identification of effective patterns of teacher behavior which facilitate child performance and skill development toward instructional objectives.

Data supporting the content or process of most current training programs is either lacking or inadequate. Results thus far have suffered from methodological problems, subjective judgments, inadequate criterion measures, and sampling problems (Balow, 1966). Research on teaching has been based almost totally on an intuitive approach and thus is yet in the early stages of scientific development. Comparisons between two vaguely defined conditions have usually been the byword in instructional methodologies. Any methodological problem becomes extremely complex and misleading for the teacher or researcher who does not control the relevant independent variables (Gallagher, 1967). Failure of research to produce results which exhibit superior teaching methods, i.e., patterns of teacher behavior, is attributable to the fact that the design of the method investigated did not incorporate widely enough the interacting principles of learning (Wallen and Travers, 1963).

The principles of learning cannot be ignored during training or teaching or during evaluation of either. These principles of learning, well demonstrated by research, must be accounted for during the investigation of method effectiveness, or they act as uncontrolled variables of the teaching-learning act and contaminate evaluation. In order for scientific research in education to make any major contribution, patterns of teacher behavior must be designed for investigation which do incorporate a wide range of principles of learning.

It might be advisable at this point to list some of the principles of learning as have been enumerated by Wallen and Travers (1963, p. 494–500) as principles of instruction.

Principle 1.—Behavior which represents the achievement or partial achievement of an educational objective should be reinforced.

Principle 2.—The introduction of cues which arouse motivation toward the achievement of an educational objective will increase the effectiveness with which that objective is achieved. A corollary: an optimum level of motivation exists at which learning is facilitated to a maximum degree.

Principle 3.—Practice in applying a principle to the solution of problems will increase the probability of transfer of training to new problems which require the use of the same principles for their solution.

Principle 4.—Since learners differ in their capacity to make the responses to be acquired, learning will be most efficient if it is planned so that each learner embarks on a program commensurate with his capacity to acquire new responses.

Principle 5.—If a pupil has had training in imitation, then he is capable of learning by observing demonstrations of the skills to be acquired.

Principle 6.—The learner will learn more efficiently if he makes the responses to be learned than if he learns by observing another make the response or makes some related response.

The evidence is clear that patterns of teacher behavior must be derived from scientific research on learning; consequently, it is more than time to begin thinking Gallagher's "unthinkable thoughts" (1967) on training, curriculum development, and research. Gallagher more than suggests that the millions of dollars spent on evaluation of special education programs is wasted when the typical experimental-control group treatments and pre- and post-test measurement of behavior change comprise the design. He uses his own research as evidence to recommend serious consideration of abandonment of such a research design. Because of the inherent inability to control the teacher variable, the results defy evaluation. Even when the curricula are between identical groups, the control of the teacher variable is weak.

Further, he compares research which evaluates classroom programs through pre- and post-test measures to guessing what is inside a package by its size and shape. With both classroom evaluation and package guessing, it is only possible to learn what is really inside by direct observation. Effective evaluation of classroom learning conditions, consequently, ". . . will bring a need for different research techniques and approaches," for observing and recording "actual classroom operation, teacher-student interaction, and sequencing of ideas and materials" (Gallagher, 1967, p. 444).

Direct observation of classroom learning conditions becomes a powerful tool for the valid, reliable evaluation of teacher performance and variables relevant to the teaching-learning act. Almost all researchers and authors in the field of professional preparation of special education recognize the need for experience in direct observation of the children with whom the trainee will work as teacher (Ornstein, 1964; Haubrick, 1963; Bloom, Davis, and Hess, 1965; Perlman, 1961; Strom, 1965; Wilson, 1961). Some recommend the direct observation of superior teachers in action (Olson and Hahn, 1964). Recommendations for direct observation of the teaching-learning act in the classroom have been translated into procedures which range from simply watching what goes on, to looking at and narratively describing events observed, through very complex procedures which measure the interaction in the classroom by recording behaviors observed from the teacher and from the children (Medley and Mitzel, 1963). Blatt (1966), Gallagher (1967), and Cruickshank, Junkala, and Paul (1967), as well as an increasing number of other educators, have begun to stress the importance of direct, systematic observation of child performance.

As this recognition of the need for observation of behavior began to receive increased recognition from educators, behavioral scientists from other fields, especially from psychology, were discovering that one not only could observe behaviors and make inferences but also could more scientifically record occurrences of these behaviors and the occurrences of temporally related environmental events which also could be defined, observed, and counted. Consequently, making inferences about reasons for behavior or behavior change becomes unnecessary when direct observation and recording makes exact specifications of interactions between the dependent variables and independent variables a reality.

Teacher behavior as well as child behavior can be evaluated through direct, systematic measurement. Ryans describes teaching behavior as a "complexly organized set of behavior variables that interact and combine to comprise the activities of persons as they go about doing what is required of teachers, namely, . . . (1) motivating and reinforcing behavior, (2) organizing and managing behavior, (3) presenting and demonstrating behavior, (4) evaluating behavior, and (5) counseling and advising behavior" (Ryans, 1967, p. 43). Ryans' seven reasons which support the feasibility of direct observation and systematic recording of teacher behavior in process specify that (1) teacher behavior is lawful, (2) empirical study of teacher behavior is valid, (3) "teacher behavior is observable," (4) teacher behavior exhibits observable differences, (5) teacher behavior influences pupil behavior, (6) teacher behavior has the goal of establishing specific pupil behaviors, and (7) "teacher behavior is relative."

Research findings clearly exhibit that teacher training does not use precise measurement. Consequently, results accruing only serve to continue attitudes and opinions which may be spurious. Recent trends in evaluation of teacher performance have pointed to the importance of utilizing systematic observation and recording. Such development is encouraging for the actualization of refinements in teacher training procedures which necessarily will result in better performance in the classroom.

Programs in Professional Preparation

The newness of training programs in learning disabilities makes accurate summary and evaluation of content difficult, for rapid changes are an inherent part of initial program development. The information that is included in this analysis, however, has been drawn from a brief review of the development of training programs in special education leading to the establishment of programs in learning disabilities, from a content analysis of current programs, and from a historical perspective of refinements in instruction essential to present programs.

HISTORY OF SPECIAL EDUCATION TRAINING PROGRAM

Before proceeding with a survey of current programs, a brief review of the development of teacher preparation in special education will provide a meaningful background. Professional training programs in special education have a history of establishment as far back as 1897 (Sarason, Davidson, and Blatt, 1962; Scholl and Milazzo, 1965). By 1929, colleges and universities offering full or part-time programs numbered 43. From 1949 to 1954, the number of colleges and universities offering sequences of teacher preparation in one or more areas of exceptionality increased from 77 to 122 (Mackie and Dunn, 1962). By 1953 the categories of exceptionality included the blind and partially seeing, crippled, special health problems, deaf, hard-of-hearing, speech handicapped, socially maladjusted, mentally retarded, and the gifted. The term "special health problems" includes "cardiac conditions, epilepsy, endocrine disorders, cosmetic defects, and below par conditions"—a category into which were placed children with learning disabilities who manifested no other observable handicap (Professional Standards for Personnel in the Education of Exceptional Children, 1966).

The Federal Government recognized the need to stimulate development of programs in special education in 1958 when it authorized support of training programs in mental retardation through Public Law 85–926. Since that time Federal support has been extended to include the training of personnel for all areas of handicapped children through amendments in Public Law 88–164 and Public Law 87–276.

Finally, in 1966, Federal support became available for training personnel in learning disabilities, at which time 12 institutions of higher learning were funded (Chalfant and Kass, 1967): De Paul University, Northwestern University, Yeshiva University, George Peabody College, San Francisco State College, and the Universities of California (Los Angeles), Florida, Illinois, Kansas, Virginia, Washington, and Wisconsin at Milwaukee. Along with these 12 federally supported programs there are a number of other institutions providing programs for training personnel in learning disabilities, but their inaccessibility at this time makes evaluation of their content infeasible. A substantial number of programs in learning disabilities were developed from course offerings already available as part of the standard curricula of child development, curriculum and instruction, educational psychology, remedial reading, or special education. Further, professional training programs in several other areas of exceptionality, especially programs training personnel to work with socially and emotionally disturbed children, offer training similar to the above 12 programs.

The overall concern for these exceptional children was and still is the diagnosis and remediation of learning disabilities. Throughout the long development of teacher training in special education, however, there has remained a ". . . great gap in teacher education between the everyday function of the teacher and the curriculum by which we prepare them" (Sarason, Davidson, and Blatt, 1962, p. 117).

CURRENT STATUS OF PROGRAMS IN PROFESSIONAL PREPARATION

The national picture of training programs in learning disabilities can be viewed from the type of teaching model emphasized, from training objectives specified, from the form of the programs, i.e., by courses in common and clock hours in class and practicum, from evaluation procedures used, and from degrees granted. Programs can be compared by their similarities and differences in instructional models and in their degrees of observable instructional refinements. The focus of most curricula is eclectic, without a point of view. Programs generally reflect a multidisciplinary emphasis, eclectic theory orientation, inferential basis for teacher training, and program evaluation based on listings of course names and hours. There are several programs, however, where the core curriculum is based on one model of instruction, with content designed to develop skills for designing and evaluating classroom teaching methods within the principles of learning and instruction. Teachers are trained to use behavior laws to guide their educational decisions. These training sequences have established program and teacher evaluation through direct measurement of teacher and child performance. One program not strictly designed for learning disabilities builds its training experiences around a "structured approach founded upon the concept of contiguous conditioning and developed from a detailed analysis of the psychoeducational deficits which characterize the child" (Cruickshank, et al., 1967, p. 53). The other two programs base experiences in the curriculum on procedures which apply the principles of learning and which directly evaluate the effectiveness of the specific applications on the performance of the child.

All the programs generally emphasize a core curriculum, didactic and practicum experiences in diagnosis and remediation, and supplementary experiences from courses in child development, psychology, speech and hearing, and courses providing additional remedial emphasis. State-approved programs for teacher certification in this area presently emphasize courses in learning, in tests and measurements, in special education, and in diagnostic and remedial techniques (Bateman, 1966).

Training objectives.—Specification of objectives for training are observable to some degree for each program, ranging from a few vaguely stated goals to objectives which state very precisely the skills the teacher should acquire through training. Almost all programs specify objectives using terms like development of "pertinent knowledge," or a "high level of theoretical understanding," or "aim to produce fully qualified special teachers." One program more closely approximating measurable objectives includes statements such as "development of 'clinical educator armed with the skills of a behavioral scientist,' " and making "trainees competent in understanding, diagnosing, and remediating the learning deficits." Another program approximating an observable criterion refers to the development of "general scientific problem-solving techniques, rather than specific methodological skills" (Haring and Whelan, 1966).

Unfortunately the lack of clarity in these objectives makes evaluation of teacher skills or training program effectiveness impossible. For example, how does one know when a teacher has acquired "pertinent knowledge," or has a "high level of theoretical understanding?" Even attempting to evaluate the acquisition of "general scientific problem-solving techniques" would not be very valid or reliable without specification of a more operational definition.

There are several programs, however, where training objectives are much more precise, defined more operationally in terms of responses which can be observed and measured. The following list of objectives is an example of performance criteria for one training program:

1. The teacher in training can effectively assess child performance in four areas: the academic, verbal, social, and physical requirements in the classroom.
2. The student teacher establishes systematic procedures of observing, recording, and analyzing behaviors.
3. Through this analysis the teacher establishes the child's preference for activities, and his efficiency in various task performances.
4. The student teacher acquires functional information about the presently available instructional materials within the broad range of content materials including reading, science, math, language, and social studies.
5. With this information and with assessment information on task accuracy and efficiency, the student teacher plans a wide program arrangement for both sequence and scope of skill development.
6. The trainee develops systematic procedures for maintaining ongoing task performance. This includes the continuous collection of response data on accuracy and efficiency of child performance from which to make teaching decisions.
7. The student teacher arranges programs and procedures enabling systematic management of accurate, efficient performance on instructional programs.
8. The trainee demonstrates the acquisition of these skills with individuals and with groupings of children.

The objectives are based on the fact that the skills of the teacher can be defined by the types of responses she makes under specified conditions. Comparison of the types and number of responses the teacher makes relevant to prespecified performance criteria is the basis for evaluation. Whether or not the teacher is assessing the skills of the child or measuring his performance during remediation, the teacher's skills are reflected in the way she identifies and measures the dependent variable and in the way she accounts for and controls the independent variables of assessment or remediation. Precision (1) in defining and measuring responses of a performance, (2) in isolating, identifying, and recording events in the immediate environment relative to the child's performance, and (3) in making decisions from the performance data are the requirements which exhibit her skills.

Training models.—As has been pointed out, the model upon which the majority of training sequences are based is eclectic and theoretical in orientation without a point of view although there are several programs where core sequences are based on one model of instruction. One of these programs bases its training programs on a structured approach through contiguous conditioning. The other two programs have a core sequence designed to function within the framework of application of principles of learning to teaching methods. Teachers are trained to plan and evaluate teaching methods within the framework of the principles of learning and to use these laws of behavior to guide decisions which will facilitate performance. Within these two latter programs, specific training objectives are established as terminal performance criteria, and the content and experiences of the training are designed to develop the specified skills. Further, the trainee's performance is assessed continuously in order to evaluate both (1) the trainee's approximation to terminal skill development and (2) the effect of the training procedures on acquisition of skills in the trainee. Overall, the training emphasizes improvement of instructional procedures through measurement of child performance under specified conditions.

Curriculum content.—As it has been stated earlier, programs generally include a core curriculum, didactic and practicum experiences in diagnosis and remediation, and supplementary experiences from courses in child development, psychology, speech and hearing, and courses providing additional remedial emphasis.

Training programs make an attempt to provide many viewpoints on behavior, assessment and management and teachers are trained to operate from a theoretical basis rather than from an experimental basis. The training sequence in these programs emphasizes major characteristics of these children, a historical view from any research conducted, clinical methods of identity, and educational implications and methods, all originating from a theoretical point of view. The objectives specified as goals for training are usually stated in terms providing no clarification of the actual skills the teacher will acquire.

The curriculum centers around similar courses designed to develop skills in assessment and remediation of learning disabilities (Chalfant and Kass, 1967). Experience in assessing specific deficits in learning is provided in course content which ranges from one course, providing experience in diagnosing a variety of learning disabilities, to several courses each focusing on more specific disabilities.

In training programs where the curriculum has an eclectic orientation, the core training program usually begins with a general survey of measurement and test interpretation. In these programs experience in educational assessment includes case history taking, clinical observation of behavior, clinical examination to determine intellectual capacity, discrepancy between capacity and achievement level, and identification of specific assets and deficits. These procedures are well described in section II (Bateman and Schiefelbusch) of this report.

Educational assessment usually entails a sequence of courses in tests and measurement with a minimum of one course in each of three areas: (1) Survey of tests and measurement, (2) individual intelligence testing, and (3) diagnosis of learning disabilities. These courses are designed to provide "basic skills and competencies with which to pinpoint specific learning disabilities, and to plan and implement remedial programs" (Chalfant and Kass, 1967, p. 5).

Training experiences in educational assessment vary depending on whether or not the program is eclectic or based on one model of instruction. Training programs where the instructional model emphasizes the application of the principles of learning provide experiences in educational assessment requiring procedures of systematic observation and recording of behavior during the actual teaching-learning act in the classroom or the individual setting. Records of direct observation are used to discover patterns of behavior and classroom events which may be functionally related.

Two of the three programs based on one model of instruction go beyond systematic observation and recording of specified observable behavior. These two programs also provide experiences in identification, measurement, and manipulation of the learning conditions temporally related to the behaviors receiving systematic, continuous measurement. Systematic continuous measurement of the dependent variable where the independent variables are specified and held constant during measurement is a teaching method for determining functional relationships between the child's pattern of performance and the learning conditions arranged.

Educational assessment here is concerned with an evaluation functional to the setting where remediation will take place. The training sequence guides experience in designing "teaching methods" for the child which include (1) a plan for programing the learning conditions and (2) a plan for utilization of procedures to evaluate the effects of these conditions on the child's performance (Wallen and Travers, 1963).

Training experiences in planning and implementing remedial treatment either occur concurrently with or subsequent to techniques in diagnosis. All 12 training programs federally funded underscore the diagnostic-remedial process as a single continuous entity and divide about half and half in their order of training these skills.

Quantitative description.—The required core curriculum for all the programs surveyed ranges from four to 10 basic courses, all of which present at least a survey of diagnostic and remediation practices, most of which provide specific clinical experience in assessment and remediation tactics, and some of which also require acquisition of a broad background of information and theory. Human growth and development, behavior and language skills deviance, and curriculum development are emphasized in the latter courses, taught within and without their education departments. Several of the institutions require the acquisition of broader and more intensive diagnostic skills than others. Those institutions not requiring an intensive preparation in assessment usually offer this option for those desiring the training (Haring and Whelan, 1966).

Institutions which offer extensive training programs typically list a number of supplementary psychology courses in human growth, development, and personality; a wide variety in remediation of various skill deficiencies; and several in management of various categories of exceptional children. For example, psychology courses are often provided in physiological, developmental, clinical, and personality psychology; perception, psycholinguistics, psychopathology, and neurology; various courses in theory, practice, and testing, and various courses in behavior pathology and disturbances. Course offerings in remediation of various skill deficiencies at these institutions include: Diagnosis and remediation in arithmetic and reading at all age levels within both clinic and classroom settings; curriculum development; and specific attention to learning disabilities.

Courses for the management of various categories of exceptional children are directed at emotionally and neurologically handicapped, mentally handicapped, aphasics, conduct problem children, language disordered children, learning disabilities, the deaf, and the underachiever. Courses relevant to these children are also designed for skill development in counseling, guidance, and education. Supplementary courses from disciplines other than those cited are included in departments of communicative disorders, audiology, speech pathology, deaf education, and guidance, English, and the school of medicine.

The number of courses offered as applicable to training ranges from 16 to 40 per institution. "Despite the variety of courses offered, most training programs attempt to teach the fundamentals of remediation for expressive, receptive, and associative language disorders, problems in reading, writing, and arithmetic, and in the behavioral management of children with learning disorders" (Chalfant and Kass, 1967, p. 9).

Practicum.—Every training sequence provides practicum experiences which range from training only within the laboratory environment to broad experience in the laboratory, public and private schools, residential settings, and hospitals. Practicum experiences vary greatly in ways not immediately obvious. Experiences vary in (1) amount of child contact, (2) time of initiation of child contact, (3) degree of refinement in observation exercises, (4) degree of refinement in exercises in assessment of child performance and evaluation of learning conditions, (5) degree of coordination of practicum experiences in assessment-evaluation and teaching-learning acts with didactic experiences, and (6) degree of refinement of procedures utilized to evaluate student-teacher effectiveness.

In many of the programs with eclectic theoretical orientations, observation experiences begin and end with looking at and writing a narrative description and evaluation from log notes of behaviors observed in the learning setting. The one program based on a model of environmental structure and contiguous conditioning (Cruickshank et al., 1967) has established a refined observation procedure. In order to observe changes in behavior through the year in this program, the teachers are required to make reports on the child's academic work, behavior reactions, and interactions between teacher and child from direct observation. Records are made of such specific behaviors from the child as checking work before putting it away, correcting errors immediately or later, child response to directions given by the teacher or assistant, and child response to the teacher. In this program the teacher engages in 1 hour observation and recording sessions 4 days a week for the complete year of training with one child. "These observations involved a large time segment for the teachers. Over the year they became an important source of information regarding the growth of the child. They became invaluable aids in helping to determine when a child was ready for return to the regular class in his neighborhood school" (Cruickshank et al., 1967, p. 82).

The programs designed to apply the principles of learning stress the evaluation of all classroom learning conditions as they temporally relate to performance. Here the important teacher skill is continuous, systematic measurement of child performance evaluated in terms of rate of specified response. Courses are designated to provide the trainee with experience observing behavior, specifying discrete units of behavior to count, and recording these behaviors as they occur in time in a setting where the relevant independent variables are specified precisely. Further experiences are provided in manipulating the learning conditions systematically while measurement of performance is continuously taken.

Teacher and program evaluation.—Procedures for evaluation of teacher performance and program effectiveness show a range of refinements similar to the range of refinements observable in specifications of performance criteria. Evaluation procedures generally reflect three levels of refinement. The majority of programs base teacher evaluation on a tabulation of course names and credit hours (Fargo and Haring, 1968). These same programs are programs based on an eclectic theoretical orientation and are without well specified performance criteria.

One of the programs based on a specific training model (Cruickshank et al., 1967) incorporates two half day observations of the trainee during her teaching performance in the classrooms. Her teaching behavior is evaluated against a set of performance criteria.

The two programs based on an instructional model emphasizing application of the principles of learning conduct ongoing evaluations of trainee performance during and following each phase of the program (Fargo and Haring, 1968). The teacher's observable responses during her performance and the child's observable responses during his performance in the teaching-learning act are systematically measured and evaluated. One of these two programs incorporates procedures to evaluate directly the entering skills of the trainee in learning disabilities. The entering evaluation is then utilized for two purposes. It provides information concerning level of readiness for training and information for comparison with terminal skills acquired at the end of training.

The skills of the teacher upon entering advanced training were defined by the types of responses made under specific conditions. Comparison of the types and number of responses the teacher made relevant to prespecified response criteria was the basis of evaluation. Essentially, the prespecified performance criteria were the terminal skills expected to be developed through the training program.

As the teachers entered the program, they were presented with four tasks to carry out during the four phases of evaluation. Video tape, magnetic tape, written records from the teacher being evaluated, and written records from the classroom teacher receiving assistance established permanent records of the teacher's performance. During each phase of the evaluation, specific responses of the teacher relevant to her task were specified, observed, and recorded from observation of her ongoing performance and from the written record she made of her procedures and evaluations.

Throughout the four phases she was evaluated from the responses she exhibited while (1) making an assessment of the child's skills, (2) assisting another teacher in setting up a remedial program in her classroom for a child new to the class, (3) assisting a classroom teacher in making an assessment of the performance of a child with a learning problem who was not new to the classroom, (4) assisting a classroom teacher in making an assessment of a child with a learning problem who was new to the classroom.

The major interest in these evaluations was how close the teacher approximated a scientific evaluation of skills or performance, how well she assisted another teacher to use these procedures, and what this level of successive skill approximations said about the skills which she needed to acquire.

Levels of preparation.—Each of the 12 institutions of higher learning begins training at the graduate level although several are exploring the feasibility of undergraduate programs (Chalfant and Kass, 1967). The master's degree programs train clinical or remedial teachers, itinerant teachers of individuals or small groups, and special class teachers. Training programs emphasize assessment, remediation planning, and extensive practical experience managing problems of learning disabilities. Several institutions offer post-master's programs which provide more intensive clinical practice and especially train educational specialists and supervisors. Programs leading to doctoral degrees are directed toward the training of college teachers, research personnel, and teacher training, clinic, and community service agency leadership. The doctoral programs, as well as several master's programs, are very flexible and individualized appropriately for the trainee's background, interests, and needs.

EVALUATION OF PROFESSIONAL PROGRAMS IN LEARNING DISABILITIES

To evaluate the content of current training programs and to make recommendations for future refinements as well as to provide for the establishment of totally new programs, guidelines suggested by research and by standards for accreditation and certification must be reviewed.

EVALUATION GUIDELINES

From research.—Although findings from research are few, a result of both inadequacy and scarcity of research, the guidelines arising are by far the most precise available for establishing greater refinements in instruction. As enumerated in the introduction, research points to three prerequisites to more refined instruction in teacher training: (1) Specification of performance criteria defined in terms of observable teacher responses, (2) utilization of techniques for direct observation, recording, and measurement of classroom behavior, and (3) measurement of child performance as the ultimate criterion of teacher effectiveness.

From standards.—Accreditation standards, serving to indicate the functions which institutions should be performing, also offer some guidelines from a description of characteristics of training programs. The National Council for Accreditation of Teacher Education (1957) provides the following description:

> An organization that is effective in the continuous development and improvement of the total teacher education program will be typified by (1) a clear definition of objectives and criteria for effectiveness of important aspects of the program, (2) a continuous evaluation of the effectiveness of curricula and procedures, and (3) a consistent policy of development and testing of new and promising procedures.

Although research in teacher preparation and evaluation of teacher training programs has specified requirements basic to the establishment of any professional training program which can be evaluated and which can evaluate its effects on trainees, no professional standards have incorporated these requirements. Even the certification standards established at the International Convention of the Council for Exceptional Children in 1966, calling for continuous evaluation of professional programs to facilitate training of requisite teacher skills, fall far short of the kinds of performance specifications which it should now be possible to describe. These latest standards simply reflect the current status of programs nationally, quantitatively spelling out criteria by which to assess teacher skills. The number of course hours and the names of courses are yet the essential criteria listed for judging effectiveness of performance.

Although research over the past several decades has shown the field of education some of the directions which must be taken for effective refinement of instructional procedures, education is yet very short of reaching the terminal goals essential to such refinement. Neither training programs nor standards for accreditation and certification have yet specified or established the refinements in instruction that should be visible in educational services.

EVALUATION OF CURRENT PROGRAMS

Program evaluation can follow from the refinements visible in (1) statements of objectives, (2) statements of experiences to meet these objectives, and (3) evaluation procedures. Each of the programs exhibits a degree of approximation to the criteria exhibited by research as essential to a fully adequate training program, but wide variance is evident. Statements of performance criteria range from vague to highly specific. Evaluation procedures range from pre- and postmeasurement of trainees using attitude scales, course names, hours completed, and course grades to direct, continuous evaluation of performance from task to task. Observation experiences range from "looking," to experiences requiring systematic recording of specific responses through time. Even those programs meeting the criteria set forth by research represent only a crude approximation of the educational experiences and evaluations that are necessary.

While many courses are listed and some objectives stated in most programs, there is little evidence to show that the courses meet the objectives or that the objectives are relevant to skills the teacher must have to facilitate child performance. Further, few programs evidence provisions for evaluating teacher performance. Only a few come close to providing statements of objectives and statements of experiences which coordinate relevantly. These same programs are the programs which have built more refinement into their evaluation procedures.

A general survey of the programs uncovers many similarities, but several significant differences in curriculum content are beginning to evolve (Chalfant and Kass, 1967). These differences are partly a reflection of the lack of clarity in defining "learning disabilities," partly a reflection of the diversity of fields relevant to learning disabilities, and partly a reflection of the different degrees of instructional refinement accomplished. There is general consensus from program to program on levels of proficiency of training in the core activities of educational assessment, remediation procedures, and practicum, but course content and course patterns differ greatly. From program to program there is a lack of consensus on kind and amount of supervised teaching necessary. Differences are observable in number of clock hours required and kinds of facilities available for individual tutoring, small group experience, resource room experience, and special class experience. Most programs have not yet specified minimal training requirements, although establishment of State laws and certification standards will bring about a change here.

The recent evaluation of special education training programs (Sarason, Davidson, and Blatt, 1962) is very applicable to evaluation of many of the current programs in learning disabilities. Investigators from that survey felt that typical preparation programs had not answered the "question of how to maximize the harmony between a teacher's practice and principles of learning and development." The surveys "were unable to locate the detailed descriptions of actual teaching that might lead to a better understanding of effective or ineffective approaches to accepted goals.... Further, though there was a surfeit of attractive course descriptions and vague generalizations of what the future teacher experiences and learns in the course of preparation, there was a dearth of detailed descriptions of how teachers are actually prepared" (p. 52).

The authors called for "serious analysis not only of what the university student is exposed to but also of specifically how it is structured, who structures it, and what the student himself does." They contended that without detailed descriptions of what actually goes on between student and teacher and between student teacher and master teacher, it is impossible to judge whether the theory supposedly giving rise to preparation practices is adequately reflected in the implementation of these practices.

As the professional literature has called for more and more observation in the classroom, training programs have begun to incorporate various semblances of observation procedures into training. But very few programs specify behavior skills to be taught and no program as yet assesses the performance of the child in order to evaluate skill acquisition by the teacher. Only a few programs have begun to evaluate the teacher by observing and actually recording response data, and only two of these programs attempt measurement systematic enough to yield valid, reliable results. Most programs simply evaluate teacher effectiveness by course number, names, and grades. Only one program evidences any attempt at followup evaluation of the teacher after training (Cruickshank et al., 1967).

Programs which show the most marked progress in refinement of training are those programs which have specified most precisely the skills the teachers will acquire, incorporating procedures of direct, systematic measurement of behaviors and classroom events, where direct, continuous evaluation of program effectiveness and teacher performance are conducted.

The program representing probably the greatest degree of refinement of instruction, outside of special education in learning disabilities, is the training program for the emotionally disturbed at Syracuse University (Cruickshank et al., 1967). Within this program performance criteria for the teacher are specified and experiences in direct observation are maximized, although the independent variables of the behaviors observed and recorded are not manipulated systematically to evaluate their effects. Within this program, teacher evaluation through direct observation and systematic recording of her performance, as well as through measurement of child performance, are represented. Program evaluation is accomplished through measurement of teacher performance, which exemplifies another step toward instructional refinement.

Another example of procedures to evaluate teacher performance and skill development has been established at the Experimental Education Unit at the University of Washington in a Teacher Demonstration Project. The professional training program begins with a comprehensive list of objectives which exactly specifies the skills and knowledge the teacher will acquire as she is taught how to improve the performance of the child. The skills are defined in terms of observable behavior; consequently, from phase to phase in the training program, the teacher's acquisition of skills can be observed, recorded, and evaluated against prespecified performance criteria. As her behavior exhibits acquisition of one skill, readiness for the next phase in training is demonstrated. Recent refinements in direct measurement of performance are being enhanced through utilization of video tape and techniques like microteaching (Fargo and Haring, 1968).

Final evaluation of teacher skills can be measured from the performance of the child (Medley and Mitzel, 1963; Wallen and Travers, 1963; Fargo and Haring, 1968; Ryans, 1967). Although no training program surveyed has yet begun to evaluate teacher performance through measurement of child performance, special education teachers working with Lindsley (1966) have demonstrated a very valid, reliable procedure for evaluating the classroom effects of a student teacher. These teachers keep continuous performance records for each child in specific tasks from day to day. As a student teacher is introduced to the classroom and begins to function with the child, her teaching effects can be evaluated from the changes in performance data of each child.

What is evident is that no training program has maximized the effectiveness of its training or teacher performance. Programs have not adequately incorporated into their training exercises or into their evaluation procedures the methodological tools for direct, continuous, systematic evaluation of performance. Further, performance criteria are inadequately specified as are statements and plans for program experiences relevant to the teaching-learning act.

RECOMMENDATIONS

This review of professional preparation programs for children with learning disabilities has revealed several important refinements in instructional procedures and conditions. The direction of refinements in teacher preparation is observed as a change (1) from abstract statements about knowledge and skills the teacher should acquire to precise statements in terms of what response the teacher can be observed to make, (2) from vagueness about the skills and knowledge various courses teach to statements of specific behavioral objectives of each course, (3) from statements requiring a certain number of courses in an area of competency for certification to specific statements of performance criteria which the teacher must demonstrate, and (4) from a complex theoretical base to a direct emphasis on teacher-child-classroom where behavior is the basic source of information for making educational decisions.

In addition, professional preparation programs are incorporating a wider variety of instructional resources. Several programs over the country are using video tape recording, micro-teaching, and prompting routinely. Demonstration, imitation, and supervised practicum have become commonplace in almost all programs. A greater concern for performance evaluation has been evidenced. Moreover, many programs have responded to the responsibility of program evaluation.

While significant advancements in teacher training can be noted, the following recommendations will provide a basis for further improvement in teacher preparation programs: Measurement of teacher performance for comparison with prespecified performance criteria in evaluating entering and terminal skills, and continuous, direct evaluation of the preparation program.

Recommendations basic to further refinement within any training program include (1) application of behavior principles to teaching methods, (2) continuous, direct, systematic measurement of the dependent variable in order to evaluate the effects of the learning conditions, (3) research investigating the components of instruction and other variables relevant to the teaching-learning act, (4) training other school personnel, and (5) certification standards which specify precise performance criteria.

PRINCIPLES OF LEARNING

Utilization of the principles of learning is basic to the further development of professional training programs in learning disabilities. Incorporating these principles involves specifying identifiable learning conditions and the behavior of the teacher. Principles of learning translated into principles of instruction require that method designs include arrangements for (1) reinforcement of partial as well as total achievement of educational goals, (2) motivational cues to maximize performance, (3) practice to facilitate transfer of training, (4) individualization of instruction, (5) modeling to facilitate skill development, and (6) active responding on the task to be learned. An effective design will generate the learning conditions specified.

OBSERVATION AND RESPONSE MEASUREMENT

Systematic observation and direct response measurement is essential to continuous evaluation of the instructional program of training or of teaching. Consequently, training programs must provide experiences in systematic observation of behavior where discrete units of behavior are specified, observed, and recorded as they occur in a setting where independent variables are specified and controlled as carefully as possible. Gallagher underscores the development of procedures for systematic observation of the teaching-learning act as the area which ". . . will provide the basis for greatly improved professional preparation in all fields of education" (1967, p. 445). The five step evaluation paradigm presented by Ryans (1967) as a procedure to systematically evaluate teacher performance provides precise guidelines for specifying the kinds of responses the teacher makes in the learning setting which enable direct response measurement.

RESEARCH

Refinement of teacher education programs by continuous research and investigation of programs through direct measurement of the components of instruction will result in effective identification and evaluation of the conditions of learning for training teachers and for teaching children with learning problems. Investigation of the components of instruction and interactions during the teaching-learning act can be facilitated through the incorporation of video taping and microteaching procedures as well as through other modern technology.

The direction for research is toward experimental analysis of the components of instruction utilizing direct, systematic measurement of the dependent variable as the most valid, reliable procedure with which to evaluate the effects of the independent variables of performance. This applies to both basic research and to explorations of extensions of the principles of learning and instruction as they facilitate child performance.

TRAINING OTHER SCHOOL PERSONNEL

Principals and other school personnel must be trained to apply effectively the principles of learning and must be taught to evaluate learning conditions through child performance and behavior. They must also learn to evaluate the teacher's effectiveness from specific performance criteria and from information gained through direct, systematic, and continuous evaluation. Identification of the tasks of other school personnel and their competencies in performing the tasks are essential during pre- and inservice training.

CERTIFICATION

Certification standards as they now stand or as they are newly developed, require translation or specification in operational definitions. Certification standards naturally stand to have very effective influence on training programs and will have to take the lead in training program modifications by specifying performance criteria of the teacher and the child which serve as demonstrations of terminal skill development. Current modifications in the standards of the Washington State Education Association serve as an excellent model.

The necessity for development of a highly skilled teacher as she *begins* teaching is paramount and follows from a *carefully planned* and *continuously evaluated* training program which provides broad laboratory experience with the teacher-learning act. As Gallagher defines the variables of training, "The key to the preparation of teachers lies in the need to show the teacher how to interact meaningfully with the learners" (1967, p. 445). Programs of professional preparation wield the potent force for advancements in education, for within these programs are shaped the teachers who must use that force for improvements in child performance.

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SECTION V

LEGISLATION

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A description of State and Federal legislation will necessarily reflect the relatively recent growth of the field of learning disabilities. Historically, legislation providing for handicapped children has stemmed from the concern of voluntary agencies with strong parent concern. Legislative bodies listen to pleas for laws when organizations which are representative of handicaps make their needs known.

STATE LEGISLATION

Legislative action is already in effect in some States. In a number of other States, legislation is in process. As of spring 1968, approximately one-third of the States had made no provisions for the child with learning disabilities, and approximately two-thirds of the States had services either directly through law or indirectly through inclusion in the term "handicapped child." Most of the latter States included these children through broad interpretation of the law while only one-fifth of them had specific legislation for children with learning disabilities.

SUMMARY OF STATE LAWS FOR CHILDREN WITH LEARNING DISABILITIES[1]

The following information is derived from an analysis of education statutes of the 50 States. The analysis is limited to those laws specifically mentioning children with learning disabilities or comparable terminology. It is known that many States not listed are presently operating programs for such children by including them under other legal definitions such as physically handicapped, maladjusted, etc. The reader should take caution in relating law to program. The fact that a law exists does not imply a program, or vice versa.

We have found that at present 12 States have within their education code a term relating to children with learning disabilities. Only one State, California, provides within the context of the law the type of program to be provided for such a child. Ten States either describe programs under the special education umbrella or grant the authority to determine such programs to the State education agency. The need for advisory committees and study groups to establish criteria and oversee the development of programs is articulated in the legislation of three States with only one of these States limiting the exploration to learning disabilities. Finally, very few States provide any specific information as to how learning disabilities are to be diagnosed.

The following is a State-by-State summary of the laws for children with learning disabilities.

DEFINITIONS

California (Educ. Code Sec. 6750)

"*Educationally handicapped minors*"—"Minors other than physically handicapped minors or mentally retarded minors who, by reason of marked learning or behavioral problems or a combination thereof, cannot receive the reasonable benefit of ordinary education facilities." (1963)

Colorado (123-22-3(4))

"*Educationally handicapped children*"—"Those persons between the ages of 5 and 21 who are emotionally handicapped or perceptually handicapped, or both, and who require special educational programs." (1965)

Connecticut (Public Act No. 627)

"*Learning disability*"—"Shall be defined by regulation by the Secretary, subject to the approval of the State Board of Education, after consideration by him of the opinions of appropriate specialists and of the normal range of ability and rate of progress of children in the Connecticut public schools." (1967)

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[1] Paul Ackerman, director, Council for Exceptional Children Analytic Study of State Legislation for Handicapped Children, has given Task Force III permission to include their summary in this report.

Florida (228.041(21B))

"Specific learning disabilities"—No further definition is provided nor authority for the creation of such a definition. (1968)

Hawaii (C.C.R. No. 2, page 8)

"Learning disabilities"—No further definition provided. (1967)

Idaho (33–2002)

"Perceptual impairment"—No further definition provided—State Board of Education given authority to establish program standards. (1965)

Massachusetts (71–46K)

"Specific learning disability"—"Resulting from perceptual—motor handicaps, including problems in visual perception and integration, and the reading disability known as congenital dyslexia." (1966)

Nevada (34–388.440)

"Neurological disorders or defects"—No further definition provided. (1956)

New Jersey (Chapter 29, Laws of 1966–11)

"Neurologically or perceptually impaired"—Procedures to be established by the Commissioner and approved by the State board. (1966)

Oregon (343.211(2))

"Extreme learning problems"—No further definition provided. (1965)

Pennsylvania (1376 and 1377)

"Brain damage"—No further definition given—standards and regulations established by the Council of Basic Education. (Note that this definition only applies to children attending nonpublic State supported schools or institutions.) (1965)

Texas (SB 30)

"Language handicapped child"—"A child who is deficient in the acquisition of language skills due to language disability where no other handicapping condition exists." (1967)

California (Educ. Code Sec. 6751 (a, b, c, d))

Under California law the following four programs are provided for "educationally handicapped minors":

(*a*) Special classes (elementary and secondary). Under this program educationally handicapped pupils, unable to function in a regular class, are assigned to a special class. The special classes are to be maintained for at least a minimum school day. Fundamental school subjects are to be emphasized as prescribed by the State Board of Education.

(*b*) Learning disability groups (elementary and secondary). In this program, the pupil remains in his regular class but is scheduled for individual or small group remedial instruction given by a special teacher.

(*c*) Specialized consultation to teachers, counselors, and supervisors (elementary and secondary). Under this program specialized consultation is provided teachers, counselors and supervisors relative to the learning disabilities of individual pupils and special education services required by such pupils.

(*d*) Home and hospital instruction (elementary and secondary). Under this program, a pupil who is unable to function in a school setting and who does not attend school receives instruction at the appropriate grade level at home or in a hospital or in a regularly established licensed children's institution. (1967)

Colorado (123–22–1 through 11)

Permissive programs provided under the general special education umbrella. Types of programs to be provided not discussed. (1965)

Connecticut (Public Act No. 627)

Connecticut law mandates programs for children "suffering an identifiable learning disability," under the general special education umbrella. The State Board of Education is given the authority to "regulate curriculum, conditions of instruction, physical facilities and equipment, class composition and size, admission of students, and requirements respecting necessary special services and instruction to be provided by town and regional boards of education." No further description of the type of program to be provided for such children is elaborated on in the law. "The State Board of Education (is authorized to expend funds) may spend up to $3,600 per year per child for the purposes of sending children who have perceptual learning disabilities and for whom there are no facilities for education in this State to schools, institutions or other places outside this State (furnishing) which furnish proper facilities for education of such children." (1967)

Florida (228.13)

Florida law mandates the provision of special classes, instruction, facilities for related services, or a combination thereof for all exceptional children. This includes children with "specific learning disability." No further program description is provided. (1968)

Hawaii (CCR No. 2, p. 8)

Mandates the Department of Education to "take steps necessary to insure each child with known or suspected learning disabilities or handicaps be afforded specialized instruction and other forms of assistance appropriate to his needs." (1967)

Idaho (33–2002A)

Idaho law is permissive in providing for children with "perceptual impairment" under the general special education umbrella. "Special services for exceptional children may include those services provided by special education teachers, as well as ancillary and itinerant personnel such as visiting teachers, speech therapists, audiologists, school social workers, psychologists. Supervisors of special education programs and directors of special education programs whose major responsibilities are in the supervision and administration of special education programs may be considered as providing services under this act. Ancillary personnel are those persons who render special services to exceptional children in other than the regular or in addition to regular or special class instruction. Itinerant personnel are those persons who render services to two or more schools, school districts, or locations, who are not assigned to an organized classroom, and who render services to exceptional children." (1965)

Massachusetts (71–46K and L)

"In any town or regional school district where there are seven or more children who have any such learning disability, the school committee may establish a special class for the purpose of furnishing such children the type of remedial instruction they require, and may employ a teacher with special qualifications for such a position. Such teacher may be deemed to be hired as a consultant and any probationary period may be waived for the purpose of obtaining certification." Provision is also made to send such children to nonpublic schools offering remedial treatment. (1966)

Nevada (34–388.500 and 388.520)

In Nevada children with "neurological disorders or defects" are permissively provided for under the general special education category physically or mentally handicapped minors, and as such may be instructed in special ungraded schools or classes. The State Department of Education is required to establish minimum standards for special education and no State money can be expended in districts not meeting the standards.

New Jersey (ch. 29, Laws of 1966—12 and 13)

"It shall be the duty of each board of education to provide suitable facilities and programs of education for all the children who are classified as handicapped under any section of this act. The absence or unavailability of a special class facility in any district shall not be construed as relieving a board of education of the responsibility for providing education for any child who qualifies under this act. The facilities and programs of education required under this act shall be approved by the Commissioner of Education and shall be provided by one or more of the following:

(*a*) A special class or classes in the district, including a class or classes in hospitals, convalescent homes, or other institutions;

(*b*) A special class in the public schools of another district in the State or an adjoining State;

(*c*) By agreement with one or more school districts to provide joint facilities, including a class or classes in hospitals, convalescent homes, or other institutions;

(*d*) A jointure commission program;

(*e*) A State of New Jersey operated program;

(*f*) Instruction at schools supplementary to the other programs in the school, whenever, in the judgment (sic) of the board of education, with the consent of the Commissioner, the handicapped pupil will be best served thereby;

(*g*) Sending children capable of benefiting from a day school instructional program to privately operated nonprofit day classes in New Jersey, or an adjoining State whose services are nonsectarian, whenever, in the judgment of the board of education, with the consent of the Commissioner it is impractical to provide services pursuant to subsections (*a*), (*b*), (*c*), (*d*), (*e*) or (*f*);

(*h*) Individual instruction at home or in school whenever, in the judgment of the board of education, with the consent of the Commissioner, it is impractical to provide a suitable special education program for a child pursuant to subsections (*a*), (*b*), (*c*), (*d*), (*e*), (*f*), or (*g*). (1966)

Oregon (343.221 and 343.235)

Special education is mandated for children having "extreme learning problems" under the general special education umbrella. Special education includes "special instruction for handicapped children in or in addition to regular classes, special classes, special schools, special services, home instruction and hospital instruction." The Superintendent of Public Instruction is given the authority to establish criteria to guide the development and operation of special programs. (1965)

Pennsylvania (1376 and 1377)

Pennsylvania's general public school laws for exceptional children are quite broad and do not include specific disability definitions; however, the laws under these two sections provide for the education of brain damaged children in nonpublic State supported schools and institutions. The two sections establish the procedures for application to such facilities but do not specify the programs to be administered. (1965)

Texas (SB 30)

No program provided—limited to an advisory council to study and research the problems of language handicapped children. (1967)

Advisory Committees and Study Groups

Idaho (House Concurrent Resolution No. 16)

Authorized the legislative council with the cooperation of the State Board of Education, the Idaho School Trustees Association, the Idaho Association of School Superintendents, and local school administrators, to conduct a thorough study of the following areas of service to exceptional children:

(1) The number and geographical location of exceptional and handicapped children in the State.

(2) The types and kinds of special services which would benefit such children;

(3) The estimated cost of providing special services for such children;

(4) An analysis of the cost of special services in relation to the benefits to be derived from the program and suggestions concerning State and local responsibility in meeting such costs.

(5) The role and relationship of private institutions, hospitals, and private rehabilitation centers in conducting a program of special services;

(6) "Any other factors which are relevant in formulating, implementing and administering a special program for exceptional and handicapped children." (1965)

New Jersey (ch. 29, Laws of 1966–19)

Commissioner of Education "shall appoint biannually an advisory council with the approval of the State Board of Education which will consist of not less than seven nor more than 15 members representative of professional and lay interests. The advisory council shall advise in the promulgation of rules, regulations, and the implementation of this act and the establishment of standards and qualifications for the professional personnel. The council shall serve without remuneration." (1966)

Texas (SB30)

This act establishes an advisory council for "language handicapped children." The council is to consist of 12 members appointed by the Governor. The duty of the council is to study the problems of "language handicapped children" and to advise the Commissioner and the Texas Education Agency of developmental programs designed to diagnose and treat the problems of such children. Furthermore, the council is to report in 1970 to the 62d Texas Legislature its findings and recommendations concerning the establishment of statewide diagnostic and treatment facilities for language handicapped children. (It is interesting to note that in 1965, a similar committee was established with a similar task. This committee was to report its findings to the 60th Texas Legislature.) (1967)

Diagnostic Procedures

California (Educ. Code, sec. 6752 and 6755)

School districts operating programs for educationally handicapped minors may not enroll at any given time more than 2 percent of the school district enrollment in such programs. No minor shall be required to participate in a program unless the parent or guardian of the minor files written consent to the governing board of the school district. "Admission of educationally handicapped minors to programs established under the provisions of this chapter shall be made only on the basis of an individual evaluation according to standards established by the State Board of Education, and upon the recommendation of its admissions committee which shall include a teacher, a school nurse or social worker, a school psychologist, or other pupil personnel worker authorized to serve as a school psychologist, a principal or supervisor, and a licensed physician." (1967)

Colorado (123–22–7 (3))

"The determination of existence of an educational handicap shall be made, with the consent of the parent or guardian of the child, by a committee of professionally qualified personnel appointed by the Board of Education of the school district. The composition of said committee shall be prescribed by the State board and may be composed of, but not limited to, the following: A psychologist, a social worker, a physician, a school administrator, and a teacher of the educationally handicapped." (1965)

Connecticut (Public Act No. 627)

"The State Board of Education shall define the criteria by which the town or regional district shall determine whether a given child is eligible for special education . . . and such a determination shall be made by the district when requested by a parent or guardian or upon approval by a physician, clinic or social worker, provided the parent or guardian so permits." (1967)

Florida (230.23)

Requires that school districts provide "necessary professional services for diagnosis and evaluation of exceptional children." (1968)

Idaho (33–2001)

Establishes that the State Board of Education shall determine the eligibility of exceptional children for special education programs. (1965)

Massachusetts (71–46K)

Requires the school district committee of every town and regional school district to ascertain the number of school children of school age resident in the district, who have specific learning disabilities. Regulations for the census are to be prescribed jointly by the Department of Education, the Department of Public Health, and the Department of Mental Health. (1966)

Nevada (388.460)

The law does not establish the processes for diagnosing children with neurological disorders or defects; however, it does note that "no minor shall be required to take advantage of a special provision for the education of physically or mentally handicapped minors if the parent or guardian of the minor files a statement with the Board of School Trustees of the school district showing that the minor is receiving adequate educational advantages." (1956)

New Jersey (ch. 29, Laws of 1966—19, 20, 21)

Authorizes the Commissioner of Education to establish in each county a child study team to function in consultation with local boards of education to identify and diagnose children needing special educational services, report and refer children with severe handicaps to appropriate agencies for placement and/or treatment, and conduct psychological evaluation and social case work services. (1966)

Oregon (343.241)

"In order to receive special education, a handicapped child shall be certified as eligible for such services by the Superintendent of Public Instruction . . . Certification requires a determination made on the advice of qualified educational and medical authorities that the child has the mental health and ability to benefit from special education and which shall include a medical examination. However: (*a*) the school district may waive a medical examination of children who are eligible for special education because of speech defects or extreme learning problems; (*b*) a medical or visual examination may be required when children have received special education but have not made satisfactory progress therein." (1965)

Federal Legislation

At the present time, Federal funds are available for the preparation of professional personnel in the education of handicapped children and for research and demonstration projects relating to the education of these children under Public Law 85–926, as amended. As defined in this law, "the term 'handicapped children' includes mentally retarded, hard of hearing, deaf, speech impaired, visually handicapped, seriously emotionally disturbed, crippled, or other health impaired children who by reason thereof require special education and related services." Children with learning disabilities are included with the clause ". . . or other health impaired who by reason thereof require special education." (For the year 1968, approximately $720,000 is being spent for teacher training programs and approximately $300,000 is being spent for research and demonstration projects in learning disabilities.) A complete listing of these programs is available from the Bureau of Education for the Handicapped, Office of Education.

Under title VI of Public Law 89–10, as amended, the Commissioner of Education announced, on January 12, 1967, the establishment of a Bureau of Education for the Handicapped. This Bureau is "the principal agency in the Office of Education for administering and carrying out programs and projects relating to the education and training of the handicapped, including programs and projects for the training of teachers of the handicapped and research in such education and training." A complete description of Bureau activities is given in the entire March, 1968 issue of "Exceptional Children," volume 34, Number 7.

Another product of title VI was the establishment of the National Advisory Committee on Handicapped Children. This committee was composed of both professional specialists and interested lay citizens. The membership of the committee decided to concentrate on two major tasks that could be accomplished during the 6 months period before its first official report was due.

The first task was to determine the current status of the educational programs for the handicapped in the U.S. Office of Education by examining the activities of the Bureau of Education for the Handicapped.

The second task was to develop recommendations in four areas of special needs: (*a*) The handicapped child in the inner city, (*b*) the handicapped child in rural settings, (*c*) children with special learning disabilities, and (*d*) preschool programs for handicapped children.

The report to Congress of the National Advisory Committee states the following on their third area of special need—children with special learning disabilities.

SPECIAL LEARNING DISABILITIES

"There has been increasing public understanding and concern about special learning disabilities. Local, national, and international organizations have been formed by parents of children with perceptual disorders, brain injury, learning disabilities, or dyslexia. Seven State legislatures have already enacted special legislation to establish educational programs for such children. Several Federal and private agencies have appointed study committees or sponsored conferences to discuss this handicap area.

"The problem of special learning disabilities should be considered as part of a larger issue of the classification of handicapped children. The traditional categories under which special education programs have been organized tend to employ medical rather than educational terminology. These categories often do not correspond to the types of programs required to meet the educational needs of the child. It is the hope of the committee that attempts to clarify the issue of special learning disabilities will lead to reexamination of the current system of classification of handicapped children in general.

"Confusion now exists with relationship to the category of special learning disabilities. Unfortunately, it has resulted in the development of overlapping and competing programs under such headings as 'minimal brain dysfunction,' 'dyslexia,' 'perceptual handicaps,' etc.

"A Federal study, sponsored jointly by the National Institute of Neurological Diseases and Blindness, the National Society for Crippled Children, and the Office of Education, is now in progress to attempt to define more clearly the nature and extent of these problems, and to provide a basis for the planning of more effective programs of research and service. Prior to the completion of this study, it is necessary for the Office of Education to formulate a definition. To serve as a guideline for its present program, the committee suggests the following definition:

> Children with special learning disabilities exhibit a disorder in one or more of the basic psychological processes involved in understanding or in using spoken or written languages. These may be manifested in disorders of listening, thinking, talking, reading, writing, spelling or arithmetic. They include conditions which have been referred to as perceptual handicaps, brain injury, minimal brain dysfunction, dyslexia, developmental aphasia, etc. They do *not* include learning problems which are due primarily to visual, hearing or motor handicaps, to mental retardation, emotional disturbance or to environmental disadvantage.

"From an educational standpoint, special learning disabilities must be identified through psychological and educational diagnosis.

"The total number of children involved cannot be accurately determined until more adequate diagnostic procedures and criteria have been developed. The disorders may range in degree from mild to severe. While the milder degrees of learning difficulties may be corrected by the regular classroom teacher, the more severe cases require special remedial procedures. A conservative estimate of the latter group would include from 1 to 3 percent of the school population.

"It is already clear, however, that there is an urgent need for more extensive research on the etiology, diagnosis, psychoeducational assessment and remediation of special learning disabilities. There is an even more urgent need for trained personnel—particularly for personnel in special education.

"Therefore, the committee recommends that: Funds appropriated for research and training programs for children with special learning disabilities should be substantially increased. Such additional funds necessary to define and explore this new area, should not be allocated at the expense of the pressing program needs in established areas."

PURPOSE OF LEGISLATION

Legislation by itself does not guarantee adequate service, but must be effectively implemented with adequate appropriations. With compulsory education a fact in most States, any lack of educational opportunity may be considered a serious oversight. Just such an oversight seems to exist in the area of learning disabilities. For many children, there are few, if any, services in their communities, and parents often must pay high fees for private placement. A vast number of letters expressing concern about the lack of services for large numbers of such children throughout the Nation come to government officials and voluntary agencies.

Optimally, the purposes of legislation should be the following:

1. Educational opportunity should be available for all children and parents should have legal recourse if such is not made available. This is consonant with the philosophy of compulsory education.
2. To permit and encourage the development and evaluation of new trends through experimental programs.
3. To provide minimal benchmarks or standards for the education of all children. Such legislation should not preclude the enrichment of programs but should guarantee some kind of service where it is needed.
4. To provide funds for the implementation of standards such as those for facilities and personnel.

RECOMMENDATIONS

Task Force II recommends that "special learning disabilities" be mentioned by name or synonym in State and Federal laws. Special learning disabilities include conditions which have been referred to as minimal brain dysfunction, perceptual handicaps, brain injury, dyslexia, development aphasia, etc. The present inclusion within the phrase ". . . or other health impaired" necessitates a health basis; yet actual injury or damage to the brain cannot be found in many of these children.

Implementation of this recommendation would not preclude variability and creativity in the provision of needed services. As research projects, university training programs, and State and local services develop, definitions and statements of need will vary from conservative to broadly inclusive. For example, one State uses 1 percent of the school population as its official prevalence figure, while another uses a 10 percent estimate of incidence.

Task Force II expresses the hope that the results from research projects and personnel training programs, together with the cooperative action of a variety of organizations, will provide a sound basis for legislative action which will successfully fulfill local, State, and National needs in the area of learning disabilities.

PART II

Minimal Brain Dysfunction—National Project on Learning Disabilities in Children

Report of Committee on Medical and Health-Related Services

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INTRODUCTION

The conditions termed minimal brain dysfunction may compromise the life adjustment and achievement of affected individuals. Even though understanding of these conditions is imperfect, anyone concerned with the provision and improvement of services to children should be committed to make optimum use of the best understandings available to intervene in what may be a difficult and pernicious developmental process. Availability of appropriate services during developmental years may well be the factor most decisive for optimal functioning in later years.

Children with deviations of learning and behavior due to minimal brain dysfunction require medical and health-related services which are conveniently accessible, comprehensive, and continuing. These essential resources must be intimately and functionally related to specialized psychological and educational services which will, in most cases, carry major responsibility for modifying behavior, and for improving skills of communication and learning. No blueprint is available as a guide to organize and provde these services in communities where they are deficient; none is offered in this report. Instead, the essential features of medical and health-related services are emphasized, in recognition that different communities and agencies will provide these services in different ways, dependent on local patterns and opportunities.

Adequate diagnosis and treatment of children with minimal brain dysfunction demand the joint participation of educational and health-related services in case finding, evaluation, and management. The diversity of problems among these children emphasizes the need for highly individualized considerations. Different kinds of services will be paramount at different ages and for different children.

The report of Task Force I of this project [1] serves as the starting point for the work of the Medical and Health-Related Services Committee of Task Force II.

The previous report defined minimal brain dysfunction as a state descriptive of

> . . . children of near average, average, or above average general intelligence with certain learning and/or behavioral disabilities ranging from mild to severe, which are associated with deviations of function of the central nervous system. These deviations may manifest themselves by various combinations of impairment in perception, conceptualization, language, memory, and control of attention, impulse, or motor function. These aberrations may arise from genetic variations, biochemical irregularities, perinatal brain insults or other illnesses or injuries sustained during the years which are critical for the development and maturation of the central nervous system, or from other unknown organic causes.

The report of Task Force I emphasizes the relative integrity of cerebral function in these children, except for relatively specific syndromes which influence behavior and impair efficiency of learning. The definition allows for the possibility that early severe sensory deprivation can result in malfunctions of the central nervous system which may be permanent. It further states that, during the school years, a variety of learning disabilities is the most prominent manifestation of the condition.

In setting the limits of the problem, the report of Task Force I provides nomenclature which suggests criteria for diagnosis, and which associates minimal brain dysfunction with other states of deviant neurologic function. The concept of diagnosis is a dual one: identifying a cause of the disability, and describing its nature in a functional context. While the former is considered to be primarily in a sphere of medical science, as it identifies and assigns relative importance to an admixture of organic and environmental influences, the description of function and its consequences is the combined concern of all talents which work with and for children. Diagnosis which is helpful to the management of these children is a continuing process which combines many professional endeavors.

Diagnostic attention focuses on the years of early childhood, when subtle deviations in development may precede symptoms more obviously related to minimal brain dysfunction. Even then, except for a few rare conditions, events productive of minimal brain dysfunction have usually ceased in activity, so that the basis for therapy no longer rests on a traditional disease-specific curative approach. Concern focuses instead on the plasticity of the developing nervous system which may allow compensation for loss of circumscribed functions either in the natural course of development or by means of training, special educational techniques, and attenuation of emotional stress.

Against this background, and in the interests of preventing neglect or mismanagement of children with minimal brain dysfunction, the following approach to medical and health-related services is set forth.

IDENTIFICATION OF THE CHILD WITH MINIMAL BRAIN DYSFUNCTION

Observations leading to identification of children with minimal brain dysfunction are frequently not made until the school years though there may have been unattended behavioral antecedents.

It is a child's failure to meet an age dependent level of expectancy in learning and behavior which eventually singles him out.

Such failures are sometimes attributed to social and cultural provocations, examples of which are negative elements in the learning milieu: a child's inability to tolerate demands of a formal, and often inflexible classroom. Incriminating as these circumstances may seem as sufficient explanations for failure to achieve as expected, the possibility is profound that the stresses have in fact identified a child with specific learning disability or intrinsic deviation in cerebral function.

In the past, emphasis has attached to the concept of a maturational lag, a term which supposes a permissible wide range of early achievement to be "normal" for a given child and which requires only the passage of time for correction to a more favorable "norm." Current concepts have narrowed this permissible latitude. With respect to reading, for example, significant progress is expected by the end of the second grade.[2] Prior to this age, any marked discrepancy between the developmental progress of the individual child and that of his age-matched group is sufficient cause for investigation.[3]

Detailed considerations bearing upon the identification of minimal brain dysfunction in formal educational settings are covered in the companion report. It is worth noting, however, that the physician, often the professional person to whom parents will first go for help, may complement the school effort by giving screening reading tests in his office.[4] One report indicates that this procedure has detected previously unrecognized reading disability later confirmed by more precise testing in the hands of a qualified educational diagnostician.[5] [6]

Often antedating the manifestations of minimal brain dysfunction in primary school are a number of behavioral hallmarks. Among these are slow maturation and unusual behavior. An especially important cue is delayed or atypical language development. If judged in the light of environmental example and stimulus, language can be expected normally to advance from infancy through graded levels of complexity. Aberrations deserve study, even in the very young child.

The atypical behavioral manifestations of minimal brain dysfunction, the range of which is tabulated in section VI on Symptomatology of the Task Force I report, deserve attention in the preschool years. One of the most obvious disturbances is hyperkinesis, or excessive motor activity of an unfocused nature. It differs from the concentrative exploration of many bright and inquisitive 2- and 3-year olds, or the attention seeking turbulence of the displaced sibling. Hyperkinesis of cerebral dysfunction usually has an undirected quality.

Hyperactivity is not a necessary feature. Some children with minimal brain dysfunction exhibit an opposite or low level of motor activity. In such cases easy distractability or limited ability to sustain attention may be present.

Definitive identification of the child with minimal brain dysfunction or the prediction of a disability in the acquisition of the higher order cognitive skills prior to the age of 3 years, using the well standardized developmental tests, is generally unreliable in our present state of knowledge. In skilled and experienced hands these measures have been found to correlate well with intellectual functioning levels obtained later by use of the established psychometric tests. It appears safe to speculate that failures specific to the development and use of language will identify a large number of children eventually fitting the definition for minimal brain dysfunction; little else is available to predict reliably evaluation of the syndrome in a child less than 3 years of age.

Precise elements of identification as they relate to distinctive evaluative procedures appear in sections of this report which follow.

EVALUATION OF LIABILITIES AND ASSETS

Developmental irregularity, behavioral deviation, school failure, or doubtful findings on screening procedures and preliminary medical assessments may suggest the possibility of minimal brain dysfunction. Exploration of that possibility requires the coordinated services of a professional group which might include minimally a pediatrician, neurologist, psychologist, language expert, education specialist, and not infrequently, a psychiatrist. Such a team, rarely available outside of a medical center, must be in free and frequent communication with colleagues from a number of other specialties and geographic areas for consultative assistance.

The group ideally reaches a cohesive and mutually confirmatory conclusion, or working formulation, on the origin of the condition and the nature of the symptoms. These views are interpreted to parents and effectively transmitted to educational authorities and others involved in continuing management.

Constant monitoring and recurrent appraisal are essential; a system of surveillance must be established, usually in collaboration with a school. Specific responsibilities must be assumed by the participating professionals to avoid duplication of time and effort, to expedite changes in habilitative programing, and to assure prompt and continuing care as long as it is necessary. Need for such intensive medical services will decrease as the child reaches and maintains a favorable adjustment, improves language skills to a point commensurate with age and intelligence level, or develops critical learning functions to a level which would make possible the attainment of these goals.

MEDICAL AND NEUROLOGICAL EVALUATION

A medical history and physical examination constitute an essential part of evaluation, especially with respect to etiology. Precedent disease or insult affecting cerebral development is rarely identified by any single fact of history or physical finding. Rather it is incriminated by a constellation of descriptive information. Family history of late onset of speech, of reading or learning disabilities, or of inadequate social environment give clues to the possible background of the presenting complaint. History of infection or trauma which could affect brain development adversely and which occurred during gestation, paranatally, in infancy or in childhood will help to focus the diagnostic evaluation.

Chronic or subacute disease may affect a child's ability to learn; careful physical examination is mandatory. Such illnesses as secretory otitis media, childhood streptococcosis, or urinary tract infection secondary to a congenital anomaly, to mention only a few, are examples of the types of illnesses which must be diagnosed and treated before any other investigation is undertaken.

Classic neurologic examination is based on a body of knowledge derived mainly from disease in adults. Although such data are applicable to the majority of neurological diseases in children and even in older infants, there are some instances of neurological disease in children for which adult based data of neurologic function are either inadequate or are in need of modification. Such is the case in minimal brain dysfunction, for here the most common signs of disordered neurophysiology are found in tests of neuromuscular coordination of fine and gross movements of the extremities, of extraocular movements, or maintenance of certain fixed postures of the extremities, of interpretation of multiple visual or tactile stimuli, of ability to name objects or to read, of maintaining attention, and of controlling impulses. The great difference between children and adults neurologically is that a child's abilities to perform the tests described are constantly changing with age while the adult remains consistent for many years. Age specific standards are applied to some parts of the child's neurologic evaluation, but these standards are neither precise nor extensively documented as are somewhat similar data used by the psychologist. The neurologist's evaluation on the adequacy of performance is often subjective. A variable standard based on the child's age and the examiner's experience is used for some parts of the examination. Such testing admittedly leads to differences in technique and interpretation among different neurologists. How important this is to the diagnosis of minimal brain dysfunction is not known. A preliminary report of interexaminer reliability in a sponsored collaborative study of cerebral palsy has shown that with some test items, there is disagreement and in others good agreement among multiple examiners of the same patient.[7] The difficulty of interpreting the significance of these small aberrations of neurological function is pointed up by the experience of Copple and Isom [8] who report that children of superior intelligence and with no learning or behavioral abnormalities may show some but not all of the disabilities of neurological function noted among children with minimal brain dysfunction. Despite these apparent limitations, the importance of the so-called minor signs of neurological dysfunction is well recognized for the diagnosis of minimal brain dysfunction.[9] [10] [11]

Conventional neurological examination is heavily weighted in testing noncortical regions, i.e., spinal cord, brain stem, cerebellum, basal ganglia, primary motor and sensory pathways and peripheral nerves. Since it is important in minimal brain dysfunction to have more information concerning behavioral and cognitive function, the examination has been appropriately modified. Appendix A contains an outline describing a neurological examination devised for children ranging in age from 3 to 12 years and containing modifications which are especially applicable to children suspected of having minimal brain dysfunction.

Examination of children with minimal brain dysfunction usually will reveal one or more of the following signs of abnormal neurological function after taking into account the patient's age: Hyperactivity, short attention span, abnormalities of resting muscle tone, clumsiness of gross or fine motor movements, hyperactive deep tendon reflexes, extensor plantar responses, abnormal extraocular movements, apraxia of face or tongue, abnormalities of position sense or simultagnosia, choreiform movement of fingers, abnormal resting postures reflecting the persistence of a dominant avoiding reaction, synkinesias, mild ataxia, minimal gait abnormalities with asymmetries of associated movement, right-left confusion, abnormalities of visual-motor skills, perceptual abnormalities, dysphasia, finger agnosia and dyslexia.

Neurological examination of the child with minimal brain dysfunction serves several purposes. It assists in identifying the child with organic brain disease who may require further diagnostic procedures and specific therapy. It helps to clarify reasons why the child may not perform up to his expected level as judged from his scores on intelligence tests. Finally, it helps to allay suspicion of organic brain disease in children with adjustment reactions of childhood whose overactivity and other symptoms may have suggested endogenous cerebral dysfunction.

The child with minimal brain dysfunction who is thought to be normal on the basis of the neurological examination may function abnormally on the psychological examination. Such discrepancy is not contradictory but rather indicative of the difference in the type of brain function measured by the two systems of examination, and to a lesser degree, by the sensitivity of the assessments. Repeated neurological evaluation of children with minimal brain dysfunction is occasionally warranted. Indications for repeated examinations include those children whose behavior or activity has changed significantly after the first examination, and in whom one suspects the occurrence of progressive brain disease, those with seizure disorders, those who take medications (stimulants, tranquilizers, anticonvulsants), and those children who are being studied to determine the relation between initial neurological findings, psychological status and future course as affected by any form of medical therapy, special teaching methods or environmental manipulation. The tendency for the signs or symptoms of children with minimal brain dysfunction to improve spontaneously with time is frequently alluded to, but it is an observation sorely in need of objective, prospective documentation.

The major purpose of the neurological examination is to assure the absence of slowly progressive brain disease, or organic brain disease that needs immediate therapy (metabolic, neoplastic or demyelinating disease) or nonprogressive brain disease, which needs chronic therapy, e.g., a seizure disorder. The neurologist is in a position also to determine the appropriateness of attempting to modify the behavior of the hyperkinetic child through the use of medication.

The most difficult decision which the neurologist must make is to determine whether the existence of minor signs of abnormal neurophysiology have relevance to the patient's presenting complaint. Frequently, this decision must be made in conjunction with information from the medical and social history, psychological testing, and school performance data. In selected instances, information obtained from the psychiatrist, social service investigator, and the electroencephalograph may all be necessary.

ELECTROENCEPHIC EVALUATION

The electroencephalogram is an important but frequently misused supplement to the neurologic examination.

.Children with minimal brain dysfunction are diagnosed from a summation of results of examinations by professional persons in several disciplines, and there is no single physical, neurological or laboratory datum which, alone, substantiates the diagnosis. Despite this fact, there is one test which is widely and erroneously regarded as a sine qua non for the identification of minimal brain dysfunction, i.e., the electroencephalogram (EEG). Misuse of the EEG arises from misunderstanding of its value and limitations. To help clarify this circumstance, the following discussion is presented.

The electroencephalograph measures the frequency and voltages of oscillating potentials which are derived from the scalp surface and which originate from electrical activity of the brain beneath. Frequency and voltages vary with the area of the brain underlying the exploring electrode, with the age of the patient, and with the state of consciousness. Electrical activity of the dendrite is believed to be the major basis of the EEG.[12] It is not clear how much of the brain's total electrical activity is reflected by electrodes which commonly cover only about one-third of the brain. This discrepancy probably accounts for part of the problem posed by patients who have gross pathology, such as intracerebral hemorrhage, deeply situated tumors, or a discharging focus in the amygdala, but a normal EEG.[13]

Interpretation of the EEG is difficult. Standards of normality vary according to the patient's age and state of consciousness. The recording technique is important, as some abnormalities appear only in sleep tracings,[14] and others are difficult to recognize unless monopolar as well as bipolar techniques are used. Because of these many variables interpretations may be biased.

The significance of normality and abnormality, when clearly established, is not always easy to determine even in the light of clinical data. For example, a patient with brain tumor or grand mal epilepsy may have a normal tracing. On the other hand, a patient with 14 and six per second positive spikes may have no symptoms, may have a severe behavior problem, or may have a seizure disorder. The significance of this wave form is doubly hard to interpret when one knows that 21 percent of unselected controls ranging in age from 4 to 16 years show the same spikes.[15]

There is no electroencephalographic change which is pathognomonic of behavior abnormality in children. Among children with behavior disorders showing hyperactivity, autism, or juvenile schizophrenia, one author with wide experience noted few significant electroencephalographic findings. This author states that the most common abnormal electroencephalographic patterns occurring with psychiatric and emotional disorders are 14 and six per second positive spikes, six per second spike wave discharges, and negative spikes in the temporal or frontal areas.[16] In another study of children with behavior disorders, the most common abnormality noted in the electroencephalogram was an excess of slow activity which was either diffuse or predominant over the temporal area.[17] This finding suggested immaturity of the brain's electrical activity, as frequencies increased with aging of the child. Excess of slow activity in the EEG occurred in 50 to 60 percent of children with behavior disorders; 10 to 15 percent of normal asymptomatic children showed the same EEG "abnormality."

Children with the diagnosis of behavior problem associated with hyperactivity and signs of brain dysfunction (tantamount to the minimal brain dysfunction syndrome) may have electroencephalographic abnormalities. The type of abnormality and its incidence vary among authors who report the cases. Among 10 groups of such patients,[18-27] comprising 722 cases, 47 percent had abnormal EEG's. The incidence of the abnormal tracings was 14 percent of 121 controls or normal children.[27] [28] Abnormalities of EEG consisted of diffuse or focal, paroxysmal or recurrent independent wave forms. In one group of hyperactive children with behavior problems, patients were divided into two groups: those with and those without neurological abnormality.[22] A higher incidence of any EEG abnormality as well as of focal EEG abnormalities was present in patients with abnormal neurological findings. In none of the patients in this series was there an electroencephalographic pattern specific for diffuse brain damage or indicative of minimal brain dysfunction.

These observations substantiate the statement that there is no electroencephalographic abnormality which is diagnostic of diffuse brain damage, of minimal brain dysfunction, or of behavior disorders of any kind. Patients with the syndrome of minimal brain dysfunction may have EEG abnormalities, but when they occur problems arise of defining the relationship between the EEG abnormality and the clinical picture. This is not always easy.

The greatest value of the electroencephalogram in patients with minimal brain dysfunction is to corroborate a suspicion that paroxysmal symptoms may be due to cortical epileptogenic discharges. Epileptogenic discharges may be associated with clinical seizures but it is important to realize that some clinical seizures may be difficult to recognize, i.e. recurrent petit mal absence [28] or interictal behavior abnormalities in children with psychomotor epilepsy.[29] [30] Patients with one type of seizure equivalent state, i.e. recurrent attacks of headache accompanied by nausea, vomiting, paleness, and brief sleep combined with behavior abnormalities, normal neurological examination and 14 and six per second positive spikes in the EEG comprise another difficult category. The problem in this instance is to determine by further evaluation, which may include psychological and psychiatric consultation, as well as a trial on medication, possible relationships between symptoms and EEG abnormality.

Indications for recording an electroencephalogram in patients with a history suggesting minimal brain dysfunction syndrome include the following:

(*a*) paroxysmal behavior abnormalities
(*b*) history suggesting petit mal seizures as well as any obvious type of seizure
(*c*) history suggesting seizure equivalent states
(*d*) history and neurological examination suggesting progressive global or focal neurological dysfunction.

Electroencephalography has a place in the diagnostic evaluation of patients suspected of having minimal brain dysfunction. The EEG is, in itself, not *the* diagnostic tool. When properly recorded and interpreted in conjunction with the clinical history and the results of the neurological examination, the EEG can help to determine whether or not the patient has a seizure disorder, a seizure equivalent state, or organic brain disease needing more detailed investigation. It cannot, however, make the diagnosis of minimal brain dysfunction.

PSYCHOLOGIC EVALUATION

Psychology is a discipline involved with assessment and modification of individual differences, and with analysis of brain-behavior relationships. Psychologists contribute to an understanding of children with minimal brain dysfunction both in diagnosis and in management or treatment.

The tools and techniques utilized by the psychologist sample cognitive, motor, sensory, and social behavior. These behavioral samples are the substance of study in psychological evaluation.

Psychological testing contributes an understanding of individual differences by means of standardized measures which describe and numerically rate various components of cognitive function. Standardization of these assessment techniques is accomplished by utilizing normal populations so that levels of expectancy for the particular function can be defined for a particular age.

Psychodiagnostics can contribute a profile of functioning indicative of an individual's current abilities which may then be compared with others of his age. An analysis of the pass-fail record as well as a description of approach to task, problem solving style, or process operation, will offer valuable information as to the nature of a specific cognitive disability. These results can provide essential information to the educator for design of teaching efforts and general child management.

The number and kind of assessment techniques available to the psychologist are many and varied. Some are shared with colleagues in other disciplines, particularly in pediatrics, education, and the language specialties.

Search for an assessment packet specific to children with learning and behavior deviations due to minimal brain dysfunction has generally been unproductive. This circumstance is the result of the protean nature of the disability, as well as the variety of symptoms which manifest diversely in different children and at different ages. The selection of appropriate tests is determined through a reasoning process on the part of the psychologist, taking into account such factors as age of child, chief complaints, major symptoms, data from other sources, placement possibilities, and other services available.

Certain data are essential to all evaluations. Among these are a reliable estimate of general intelligence, academic skill index, measures of complex perceptual functioning, behavioral descriptions, and additional indices of language, learning, and behavior as indicated by the individual child.

A highly sophisticated approach to psychodiagnostics by Dr. Henry Mark is contained in appendix B.

The nature of the treatment medium recommended by the psychologist may vary from arranging for a more appropriate school placement to engaging in psychotherapy with the child or parents.

COMMUNICATIVE EVALUATION

Our culture places a high premium on a child's ability to communicate on an abstract, symbolic level. In order to do this, the child must master an organized system of linguistic symbols (words), as well as the rules of syntax by which these words are put together in phrases and sentences. He will use these words and this syntax in listening, speaking, reading—"in talking to himself"; as well as in expressing his feelings, communicating his needs, presenting his ideas, and sharing the ideas of his fellows.

It is a complex task with many biologic and social factors contributing to its acquisition and development. The child himself must have achieved the mental age for the emergence of the anticipated steps in a developmental process. He needs relative intactness of the sensory systems, particularly hearing, and he, himself, must be an organism capable of receiving, storing, retrieving, formulating, and expressing the language code. He must have adequate control of the articulation and the phonatory mechanisms. He must live in an emotional and experiential environment that is conducive to such learning. He must have the motivation and ability to attend to a complex task, if he is to learn language and to talk at an anticipated developmental rate.

There is good clinical evidence to support the concept that delayed or retarded language and speech development is one of the earlier and more sensitive indicators of a child with a disability and for any of a number of different reasons. Therefore, a significant delay in the acquisition of language and speech should be a red flag, not only for the parents, but for the professional worker. There tends to be uncertainty as to what are normal developmental expectancies for the emergence and development of language and speech; a "wait and see" attitude often prevails to the detriment of the child.

A useful tool to assist in the early detection of children *with serious developmental delays* is the Denver Developmental Screening Test. It is not designed to obtain a measurement, i.e., a developmental age, or a mental age, or an intelligence quotient. Its sole purpose is to alert professional child workers to the possibility of developmental delays in four areas of performance (Gross Motor, Fine Motor, Language, Personal-Social), so that appropriate diagnostic referrals may be made. Its major advantages over other developmental scales is that it delineates the age when 25 percent, 50 percent, 75 percent, and 90 percent of children pass each item of the test. Therefore, a failure to pass an item at the 90 percent point clearly indicates a developmental lag that should be investigated. This is particularly critical in the Language Area; for it is in the preschool years that oral language should become a reflexive tool. Until a child achieves adequate language facility, academic learning is seriously impeded, or cannot be undertaken at all.

A significant number of children who are thought to have minimal brain dysfunction whether from insult, or from physiologic lags in maturation, have a history of delayed or retarded language and speech development. This is not a matter of transitory importance. Retardation in the auditory learning of language is often a precursor of similar kinds of difficulties in the visual learning of language: reading and writing. Speech onset may occur at the usual time, but may be slow in expanding; or onset may be delayed until 24–36 months of age. An encouraging spurt usually occurs in the third year of life, but articulation is defective. These errors of articulation tend to persist, and not infrequently are severe enough to interfere with intelligibility. There is little or no self-monitoring, and speech is best described as "cluttered." Language slowly expands but remains immature in form, content, organization and level of abstraction. These symptoms are usually related to interferences in the processing of auditory information, (attention, memory and recall of the details of acoustic experiences) rather than to hearing loss. However, the possibility of a conductive, or sensorineural hearing problem should not be ignored and hearing acuity should always be verified.

Most children with minimal brain dysfunction require specific language and speech therapy aimed at improving their listening, discrimination, and audioperceptual skills, as well as vocabulary building, concept formation, and the formulation and expression of verbal language. Some will need work in visual-motor perceptual skills. Others will need help in directional and graphomotor patterning, and many will need help in all areas.

Detailed hearing, language, and speech evaluations should be made by a specialist, or specialists in communicative disorders for the kinds of breakdown and/or interferences can be complex and are usually interrelated. The audiologist undertakes the audiologic test battery that is necessary to measure and describe the nature, shape, and depth of any hearing impairment. He should also determine if one or more hearing aids are indicated, the most appropriate kinds, and in general provide the long-term guidance and management of a child with a hearing loss. The otologist examines the ears, nose, and throat to determine if there is a condition that is amenable to medical or surgical intervention.

The speech and language pathologist not only evaluates the developmental level of the child's language and speech, but determines if there is a specific language or speech disorder. He is concerned with not only *how much,* but *how* a child hears. Auditory discrimination, as well as the child's ability to process, pattern, and retain auditory and visual information are assessed. The child's ability to comprehend verbal language is evaluated, as well as his ability to formulate and express a linguistic code. Phonation, articulation, and voice quality are analyzed and a careful appraisal is made of the speech mechanism to determine if there are any anatomic abnormalities, or motor problems to interfere with speech production. The objective is to delineate the nature of the problem, describe what it is the child can and cannot do, and undertake the necessary guidance to help the child communicate more effectively.

PSYCHIATRIC EVALUATION

People react to stress in different ways. Any handicapping condition, whether it be diabetes, obesity, or minimal brain dysfunction, generates stress. Special adjustment problems confront a person so affected; they also confront his family and associates. The following review identifies some of the patterns, by no means constant, which may be manifest in the adjustments to the stress of minimal brain dysfunction.

Description of symptoms in children differs from that of adults in that it is more dependent on the views of an outsider. Parents, teachers, and other professionals are more likely to describe the child's symptoms than the child himself. While such a description may be more objective in some ways, it also carries many qualities of the person describing the symptoms. (A feverish child is likely to be described as irritable. An adult suffering from the same condition would describe himself as miserable.) Recognition of symptomatology in children with minimal brain dysfunction includes many outside observations and judgments on the performance and activities of the child.

The motor phenomena, which are so outstanding in this condition, may result from dysfunction of perception, cognition, or integration. Whatever the basic lesion, the effects are seen either in distortions of perception on the part of the child, or in his reactions to them. Long before the mother sees her child as clumsy she may be impressed by his sensitivity and jumpiness as an infant. This response leads to maternal concern about mishandling which complicates the relationship between mother and child. Later, as the child begins to grow and is described as a "clumsy" individual, the impact of this clumsiness on others gives emphasis to the behavior of the child. He may become both hyperactive in a play situation and distractable in a social one.

Symptoms noted in the school setting often bring these children and their families to medical attention. Teachers describe them not only as failures in learning but also as troublesome children. They disturb other members of the class by their restlessness and "annoying behavior."

The affected children tend to perseverate and display confusion with instruction and direction that seem to them antagonistic. They may become, because of inability to tolerate the demands of the school, unpopular, frustrated, and inattentive. Instability of their moods exaggerates the frustration and, at times, makes it difficult for teachers to establish an effective method of discipline. Thus, the affected children are described as disobedient largely because of their difficulties in meeting the pressures and expectations of school.

What is most important to the child himself is the sense of frustration and failure. Elsewhere, Erikson has described the school age period as a crucial one in setting the sense of competency and adequacy that is required for life. Since these children may fail the demands of the school and society, they establish internal patterns of failure that are often crucial to their careers.

Interaction between a child and his family begins early. Parents are quite entitled to their expectations of their children and have an ongoing sense of reward in health performance, development and growth of their child. These expectations may be greater in the behavioral area than in the learning area in some families and quite the reverse in others. As Prechtl has clearly pointed out, the early activities of these children lead parents to feel that they are not handling the rearing process well; they may even have a sense of gross mishandling. Mothers may become concerned about their inability to quiet, soothe and comfort the child, and may develop a growing frustration that continues for years. Later the child's clumsiness may generate feelings in the parent that if the child would only try he could behave much better. It may lead, in some family situations, to pushing the child beyond his abilities or capacities to carry out simple demands that the parents make.

As with all exceptional children, their parents may be reluctant to accept or even to see some of the defects. The common symptom of denial may operate with these families as with others, and may lead to a sense of guilt on the part of the parent, both about what produced the condition and the manner in which it is being handled. Ultimately, the parent may become annoyed with the total performance of the child, antagonistic to his actions and behavior, and eventually may display either covert or overt anger at the way the child is growing and developing. The results of the child's failure to meet parental expectations may be seen in the manner in which the symptoms are described. The children are not only described as clumsy, but also as disobedient, unable to cope with social situations, explosive, and antagonistic to other children. Parents may have an acute sense of "I can't do a thing with him." Such anger, frustration and despair on the part of the parents may lead to infantilization of a child on the one hand, or a general kind of rejection on the other. It has been noted in some family studies that these children, as with any handicapped child, may interfere with the care of other members of the family and may even promote an exaggeration of differences between parents. One parent may very well feel that the child should be nurtured and the other that he should be pushed. The former feels that the latter is too demanding; the latter feels the former is "coddling" the child. The net result is marital discord with the child as focus.

In keeping with the need to observe these children with their families, a new form of treatment, family therapy, has developed. It has proved successful in bringing together members of the family who have different ideas as to life management. The opportunity for family members to vent their feelings about one another, to see the demands and expectations of each other, and to understand what can be accomplished by working together, is greatly aided. Clinicians confronted with strains in family interactions may find the convening of all parties an extremely valuable therapeutic and educational process.

Earlier, it was suggested that parents expect a certain amount of reward from all of their children. They prefer these children to grow, to develop, to learn, and to become models of behavior that will be complimentary to the family. Very often in talking with parents of children with minimal brain dysfunction, one senses a lack of reward in the performance of the child. To be able to talk about the feelings this lack of reward produces in either an individual or group setting, can be most helpful. We have also noted that guilt arises in the handling of such children and anger becomes its product. To give parents an opportunity to ventilate some of this anger in a neutral setting can be productive of a newer and a more comfortable approach to the child.

Whatever can be done in the emotional sphere to reduce a sense of failure is a crucial step in rehabilitation. Part of it depends upon modifying the child; part of it depends upon modifying the expectations of the society which surrounds him. When this involves school and teachers there is a real need to understand the ultimate capacity of the child and to adapt remedial and academic as well as social expectations to these capacities.

SERVICE COMPONENTS OF COMPREHENSIVE MANAGEMENT

After a child with minimal brain dysfunction has been identified and evaluated by appropriate diagnostic procedures a variety of management services will be necessary in order for him to achieve his maximum potential in all aspects of life—physical, educational, emotional, social, and vocational. Attention must extend to and include the family and their relationship to this exceptional child. Comprehensive management will depend in part on the availability of the following services.

GENERAL HEALTH CARE

The family physician, pediatrician, or neurologist will retain considerable responsibility for providing medical care to the child and health-related advice to his parents. The physician will judiciously seek assistance from consultants and appropriate community agencies. The physician probably will serve as coordinator for these services, at least until some other aspect, e.g., educational programing, demands greater emphasis. Hopefully, the physician will continue an active interest in the child, meeting his medical needs, inquiring of status or progress from other professionals involved, and observing the child's growth, development, and general adjustment.

The child with minimal brain dysfunction is subject to the common illnesses of childhood; his reaction to these illnesses in the light of such symptoms as hyperactivity, distractibility, perseveration, and emotional liability, may complicate treatment and call for greater than ordinary understanding on the part of the physician, who at times may need to impart this information to other clinicians involved in treatment.

The child in the course of his development will encounter many individuals who will lack knowledge or understanding of the adjustment problems imposed by minimal brain dysfunction. In such instances, the physician may be called upon to assist the parents in providing an explanation of the child's differences.

MEDICATION MANAGEMENT

One approach to the modification of symptoms of minimal brain dysfunction has been the use of medicines. This effort has been directed almost exclusively to reduction of hyperkinesis and prolongation of attention span. The paradoxical observation that amphetamines, stimulants of the nervous system, were effective in reducing hyperactivity was made by Bradley over 30 years ago[31] and to this day, these continue to be one of the most effective drugs although their mechanism of action is obscure. Because of a lesser tendency to produce anorexia, another stimulant, methylphenidate (Ritalin), may be preferred, although in some children it may not be as effective as amphetamines. Variability in response to any medication for the treatment of hyperactivity is well known among children with minimal brain dysfunction. Deanol (Deaner), also classed as a stimultant, has been found useful.

Agents which may reduce anxiety and aggressive tendencies, and concomitant hyperactivity and impulsivity, are known as tranquilizers. These include thioridazine (Mellaril), chlordiazepoxide (Librium), chlorpromazine (Thorazine), diphenhydramine (Benadryl) and reserpine (Serpasil).[32] [33] [34] These drugs should be used with an awareness of their possible side effects.

Well controlled studies using a number of reliable tests of motor function, general intelligence, impulsivity, attention span and perception, given before and after a short period of drug therapy suggest that small but significant improvement in intellectual functioning, perception, and impulsivity may be brought about by drug therapy.[35] [36]

When an appropriate clinical history and a particular type of electroencephalographic abnormality coincide with a specific behavioral abnormality, subclinical seizures may be suspected. A rationale is then present to give anticonvulsants on a trial basis to test for possible beneficial effects on the activity of such a patient. Little substantial evidence is available to decide among various drugs. One small study suggests that primidone (Mysoline) is of value. Phenobarbital has been shown to make a significant number of patients worse.[37] [38] Meager as the tabulated data are, they suggest that the two anticonvulsants most likely to be effective when given in appropriate dosage are primidone (Mysoline) and diphenylhydantoin (Dilantin).

The following table summarizes the drugs used in an attempt to ameliorate hyperactivity, impulsivity, and short attention span together with their recommended dosage.[34]

Drug	Average daily dose (mgm./kg./day)	
	Initial	Optimum
Thioridazine (Mellaril)	0. 37	1. 0
Methylphenidate (Ritalin)	0. 25	2. 0
Dextroamphetamine	0. 25	1. 0
Chlordiazepoxide (Librium)	0. 25	1. 0
Chlorpromazine (Thorazine)	0. 50	2. 0
Diphenylhydantoin (Dilantin)	5. 0	10. 0
Primidone (Mysoline)	5. 0	20. 0

Equally important in reducing the tendency to hyperactivity is a reduction of outside stimuli and of prolonged activity leading to undue fatigue. Thus shopping trips, parties or travel should be infrequent and as brief as is reasonable. Some of the more hyperactive children do best when their daily lives are highly routinized and adequate periods for sleep are gently but definitely enforced.

HEALTH-RELATED SERVICES

The multidisciplinary team commonly involved in the diagnosis of the child with minimal brain dysfunction has been described. Social workers are usually required to assist in social evaluation and interpretation; they may be essential to a program of management. The entire team of professionals makes contributions to comprehensive treatment and management of the child and the family. Significant service contributions can be made by an increasing number of interested and qualified specialists from the fields of occupational therapy, optometry, physical therapy, physical education, nursing, and vocational counseling.

The availability of the expanded collaborative team is frequently influenced by interprofessional attitudes as well as by geographic restrictions. Professional understandings about minimal brain dysfunction and learning disabilities are relatively recent and still incomplete; it cannot be assumed that all child care specialists are yet aware or trained for the many areas of service required for the child and his family.

FAMILY COUNSELING

In many cases, the family or consulting physician will be able to provide the counseling necessary for a particular child and his family. If the complexities of the situation exceed the skills or the available time of the physician, he should refer the family to a resource which he knows is well informed on the subject of minimal brain dysfunction or learning disabilities. Many communities and States now have voluntary organizations of parents established for the purpose of promoting the education and general welfare of children with learning disabilities. Such organizations can be a valuable source of information, activity, and solace for interested parents. Professionals could likewise profit from selected activities within such organizations when participation or advice is requested.

BABYSITTING

This subject may seem trivial for inclusion in a professionally oriented document, but obtaining an individual to care for the markedly hyperkinetic, impulsive child can present real difficulties for parents. An understanding person to care for such a child may be essential during the time of a mother's illness. At other times, she may provide periodic temporary relief from parental presence and responsibility and the opportunity for social and recreational activities needed to carry on the day-to-day challenge of dealing calmly and effectively with a handicapped child. The significance of this problem, of course, will depend upon the degree of the child's behavioral deficits.

Older siblings who relate well to the child with minimal brain dysfunction may provide adequate and intelligent care during temporary absence of parents. When such a sibling is not available, a trained babysitter may be the best solution. "Trained" in this instance implies a mature person with special understanding of the child and some skills in coping with his atypical behavior. It is feasible and appropriate for an organized parent group to underwrite a program of training for selected interested persons who would serve in this capacity.

PRESCHOOL TRAINING AND EDUCATION

The nursery school or kindergarten can serve many worthwhile purposes for all children. It can provide a constructive environment for play, learning, and social adaptation. Structured training for academic readiness and general preparation for regular school routine are other essential activities.

A preschool program for the child with minimal brain dysfunction can serve an additional and important function. It provides an extended opportunity for objective day-to-day observation and assessment of the child's deficits, and the institution of appropriate programs of training which may minimize their interference in formal learning. Training techniques have evolved which are believed to enhance attending and listening, language development, perception, patterns of coordination, etc.

Kindergarten personnel are in position to judge the child's readiness for first grade. They may advise parents of need for an additional year of maturation and training to enhance the possibility of first grade academic and social success. The preschool center, through parent conferences, has the opportunity to contribute greater understanding of individual differences due to minimal brain dysfunction, and aid in home management techniques. The kindergarten teacher should seek consultation from other specialists when the situation requires judgments beyond her competence.

REGULAR AND SPECIAL EDUCATION

The many and varied aspects of educational services for children with learning disabilities due to minimal brain dysfunction have been covered by the report of the Educational Services Committee which appears elsewhere in this document.

It should be emphasized however, that at this point in time, most children and adolescents so compromised are contained in the regular classroom where they are judged and documented by performance expectancies derived for an unalterable mainstream curriculum said to be designed to serve the majority of students. As a result, the youngster with learning disabilities is constantly subjected to failure and frustration which frequently moderates only when he reaches the age at which he can legally drop out of school. Problems may intensify at this time with the discovery that vocational opportunities are severely limited.

Special education has thus far taken the lead in public school programing for children with learning disabilities, and in a limited number of universities specialized teacher training programs are available. Such teachers, if not hampered by premature State certification requirements for the specialty area of learning disabilities, are pioneering in individualized teaching of the small number of children currently being served by the various types of specialized programs which have been developed in a few public school systems.

Since flexibility in programing is essential for children with learning disabilities, and since private schools can operate with a minimum of the conventional, a number of such facilities offer a variety of instructional programs. Most of these have focused on the preschool and elementary age child. Very few private and residential schools have extended their programs to include the youngster of junior and senior high age.

The cost of a private school education for a child with learning disabilities is prohibitive to most families. The main line of educational defense for the vast majority of these children is the public school system, which at this time is woefully inadequate. Programs of adjusted curricula which emphasize the basic academic skills and vocational preparation are at the experimental stage in a few public junior and senior high schools. Every possible assistance should be given to the development and expansion of such needed programs.

In terms of early intervention, the primary grades of elementary school hold the most promise for prompt detection and correction of learning disabilities. It is vital that increased emphasis be placed both in funding and in programing at this level.

VOCATIONAL SERVICES

Probability is high that difficulty in vocational selection, job finding, and job holding will befall a sizeable portion of children with minimal brain dysfunction who reach adolescence or young adulthood with persistent impairment of their ability to read, to write or to calculate. If intervention through meaningful vocational planning could take place from the moment a child is first detected by his teacher as a child with learning disabilities, the dropout rate which plagues our Nation's high schools could be reduced. This point is emphasized for adolescents with minimal brain dysfunction since their adequate adjustment to life will in large measure hinge upon their ability to make a living. At this point, the vocational counselor can provide an invaluable if not essential service. The counselor's training usually provides him with a knowledge of psychoeducational tests, occupational prerequisites and skills, prevocational evaluation, vocational training facilities and appropriate public assistance programs. His services can provide considerable assistance to the teenage or adult individual with minimal brain dysfunction in finding a meaningful place in a highly competitive labor market.

The vocational counselor cannot in all instances complete the necessary steps without the aid of other professionals. After one or several interviews for assessment of motivation, attitudes, and general interest, prevocational testing to appraise component skills necessary for various types of occupations may be helpful. Special training may initially be indicated for the development of improved work habits and interpersonal relationship skills.

Formal training in a specific occupation is indicated when the client manifests a specific interest and the potential skills combined with the necessary motivation. The counselor can assist in the selection of the training facility and in obtaining financial aid from various resources to underwrite the training when necessary.

Finally, the vocational counselor may provide job placement either indirectly through employment agencies or through direct contact with business and industry. He may be instrumental in developing an understanding of any specific disabilities of the individual on the part of management and thus help to create a better climate in which the person with minimal brain dysfunction can work.

Vocational services entail a wide scope of related activities. The only requisite to adequate service is an understanding of the underlying disorder and its effect on the individual.

RECREATIONAL AND SOCIAL ACTIVITIES

Behavioral manifestations of minimal brain dysfunction can hinder the affected child in his attempts to make or retain friends among his peers. Perceptual problems, excess motor activity, coordination deficits, are among the factors that can limit or prevent his acceptance. Just as such children may require specialized educational programing, they may also need special recreational activities and a more structured opportunity to make friends. School activities can fulfill such needs to a certain extent, but after school hours, weekends, and the summer months often present difficulties for the eager but isolated child.

A variety of summer camps and summer day programs are available in many communities. For the more involved child, similar programs designed specifically for exceptional children may be a more appropriate outlet. Year round recreational and social programs are generally offered by such organizations as the YMCA, YWCA, and boy's clubs. The Boy and Girl Scouts of America have provided special opportunities for children when existing programs do not serve their needs. The success of these and similar programs sponsored by organized groups depends upon the demand in a given community and the understanding and abilities of those directing the programs.

When it is not possible to work through established organizations, the parents of children with minimal brain dysfunction, through their own organization, may develop or sponsor appropriate recreational and social activities directed by volunteers or paid personnel.

In many instances the parents must rely on their own resources for finding suitable playmates for their child and be willing to use the home as an activity center. Since large group activities are overstimulating and often disorganizing for the child with minimal brain dysfunction, one or two playmates at a time may be best, with parents taking a more supervisory role than is usually necessary.

LONG-RANGE CARE AND SERVICES

In the absence of longitudinal followup studies of large groups of children with minimal brain dysfunction, the nature and extent of need for long-range care and services is a matter for speculation.

Children who reach maturity and are able to adapt into society with only minor or few deficits present no special problems. Even those with persistent learning disabilities are able to retain satisfactory employment in jobs commensurate with their other skills and talents. Marriage, child rearing, and other responsibilities are managed with minor, if any difficulty.

Others with more serious, persistent deficits may require continued supervision in stressful situations. Undoubtedly in a great number of cases, parents, relatives, or family friends provide all the assistance that is necessary. Such supervision may at times require supplementary services from community resources, but the major contribution and responsibility will rest with the family.

When family resources are inadequate, those in the community may make the difference between a dependent individual and one capable of meeting criteria for self-support and social responsibility necessary for adequate acceptance in the community. Resources required may include one or more of the following:

1. The vocational counselor, whose services have already been described, may have special significance

for those individuals having difficulty in occupation selection, job placement, or jobholding.

2. The professional social worker can assist the individual who may have social, marital, or financial problems. Success is contingent upon the social worker's awareness of the client's deficits and potential to profit from special help.

3. The pastoral counselor, specifically trained, may function in a similar capacity to the social worker, and may be particularly helpful to those individuals who prefer this source of aid and comfort.

4. An attorney who has understanding of the problems of exceptional persons is essential to the family wishing to establish a trust fund for the support of the adult with minimal brain dysfunction if he is inefficient in his own financial management. The attorney, a selected bank, or surviving relatives are equally important in serving as executors of such funds.

5. A sheltered workshop program may fulfill the need for some individuals with minimal brain dysfunction who are unable to cope with the competitive labor market, but who are otherwise capable of community living. Here the intent is to permit the individual to engage in a productive occupation consistent with his abilities but in a protected environment.

6. A few medical centers that maintain a high interest in minimal brain dysfunction and offer continuing support to patients through various departments, e.g., pediatrics, neurology, psychiatry.

COORDINATION OF SERVICES

Efficient management of the individual with minimal brain dysfunction requires exceptional communication among various professionals for an agreed upon, flexible course of management. The child can seldom be under the care of a single profession, be it education, medicine, psychology, or any other. Certain aspects of management, to be sure, are more pertinent to specific disciplines at different times. Delivery of services required by the child with minimal brain dysfunction calls for access to a clinical environment which can provide the following:

1. All specialists necessary for adequate diagnosis and management planning, both short term and long term.

2. Appropriate liaison and effective working relationships among community resources, particularly between medical personnel and school systems. (Interdisciplinary conferences regarding individual patients are almost essential.)

3. Long-term followup and data gathering for an adequate record system in the interest of the individual and for effectiveness of the overall program.

4. A monitoring system which insures proper discharge of responsibilities of the individual team members toward the child and the family.

These functions and resources are most convenient if provided within a single environment, which tends to eliminate the need for parental shopping for piecemeal services. It provides further advantages in the form of objective information needed for epidemiological purposes and for establishment of new services; it serves as a unit for clinical training of all the professional disciplines who work with and for children and their families. In most communities, however, the participation of several agencies will be necessary.

IMPLEMENTATION OF SERVICES

The implementation of long-range services must take into account the probabilities of eventual outcomes as children with minimal brain dysfunction reach maturity. Here, unfortunately, objective data are not available and we can rely only on impressions of relatively few professionals who, on the basis of special interest, have followed these children over a period of many years. Impressions of some observers indicate that behavioral and learning disturbances will persist through early school years; many if not most of the children with minimal brain dysfunction will show a predictable decline in the major clinical problems of distractibility, hyperkinesis, and perseveration as they approach the teen years.[39] Irregularities in some aspects of perceptual functioning, motor coordination, and scatter within intelligence tests may improve as the child approaches adolescence. Confusion in laterality may disappear. Bradley[40] and Anderson and Plymate[41] maintain that children with minimal brain dysfunction as adults are accepted into the general population and fit into social living patterns holding useful and productive jobs, though adaptation to stressful situations may be poor.

Other observers are not as consistently optimistic in their impressions. In a sizable number of children with minimal brain dysfunction learning disorders will persist to some degree; reading disability may continue throughout life.[39] Problems in concept development, symbol learning, judgment, organization of thinking and tendencies toward concrete, nonabstract thought may well continue into adulthood despite improvement in some of the major clinical problems that were conspicuous in childhood. Impressions in one clinic indicate that many of these children present evidence of damage to the processes of inhibition and self-control and are, therefore, more prone to become character problems, lawbreakers, addicts, alcoholics, or borderline adjusted cranky people.[39] Prospective and retrospective studies suggest that minimal brain dysfunction may be a precursor to the diagnosis of schizophrenia or other psychoses later in life, either as a direct result of the underlying organic dysfunction or as a secondary effect of the social and learning disabilities which complicate adjustment.[39]

Valuable as these impresions are, they do not provide objective data necessary for prediction of outcomes and their probabilities as related to the educational, medical, and social management of the individual child. Nevertheless, it seems clear that during early formative and school years most, if not all children with minimal brain dysfunction, and their parents, require in varying degrees a relatively large number of services. Availability of adequate services during these years may be difficult to achieve.

Recommendations for the improvement of health-related services for individuals compromised in learning and behavior by minimal brain dysfunction include the following:

1. Broad extension and expansion of health-related services from the prenatal period through the school years. Increased emphasis should be put on the introduction of health-related and education services into all situations where groups of children commonly congregate and where they can be readily identified. These would include well child clinics, Headstart programs, day care centers, and schools. No opportunity should be lost to increase the contacts of infants, children, and adolescents with experts in child development.

Every community should in fact have one or two systematic procedures whereby children with minimal brain dysfunction will be identified. At the very least there should be a systematic preschool screening program, preferably at the beginning of the kindergarten year, when children with potential learning disability due to minimal brain dysfunction could be recognized and as a result of which, some special preschool orientation might be provided. Another systematic review, utilizing processes of screening evaluation described in this report, should be invoked for every child who experiences school failure, whether it be manifest by truancy, behavior disturbance, or slow learning.

2. Educational programs for the preparation of personnel in the health-related professions have emphasized diagnostic and curative methods to the neglect of preventive and long-term care. Many chronic disorders, including minimal brain dysfunction, do not lend themselves to dramatic curative medical procedures. Neither does our present understanding of the disorder lend itself to precise definition of etiology and pathogenesis. These deficiencies do not diminish the importance of rendering health-related services to the full extent of our knowledge. Many studies and reports have urged medical education to adopt a new emphasis on continuing and coordinated care rather than on episodic and intermittent care. This is an emphasis which we believe to be desirable in the interest of children with minimal brain dysfunction. All institutions that prepare professionals in the health, education, and welfare services should assume responsibility for teaching the diagnostic and management skills required by children afflicted with minimal brain dysfunction and learning disabilities.

3. Continuing education for health, education, and welfare professions assumes great importance in distributing new information about resources and scientific developments. Continuing education is mandatory for upgrading general professional understanding of a disorder, such as minimal brain dysfunction, which is not widely understood by many professional groups. Continuing education which is multidisciplinary in nature is a realistic and useful emphasis when considering disorders such as minimal brain dysfunction and learning disabilities which require the services of a number of disciplinary groups. These disciplines require cross exposure in their educational as well as in their clinical functions. Any agency which shares responsibility for the care of large numbers of children, especially clinics and schools, must also assume responsibility for the continuing education of its staff. In large systems this can be arranged by means of inservice training programs. Otherwise arrangements must be made through regional universities and professional organizations, nearly all of which welcome support and guidance for their efforts in continuing education.

4. Much national attention is directed toward the importance of developing and demonstrating the usefulness of paraprofessional groups in the management of disabilities. In this way, services can be extended and the influence of highly trained and experienced professionals can be broadened. This concept is of special importance for the delivery of the many and varied services required by children with learning and behavior deviations due to minimal brain dysfunction. Use of health aides, patient advocates, teacher aides, health visitors, physical therapy aides, and aides in

child development all may be means of improving the quality and availability of complete services. Such personnel can be trained in larger numbers and at less cost than more completely prepared professionals, who are in short supply and concentrated in population centers. Schools and clinics sponsored by large agencies should incorporate inservice training to prepare such aides. Mechanisms of support are available through the manpower training programs of the Department of Labor and its regional offices. Smaller communities and agencies should participate in similar training programs through Cooperative Area Manpower Planning Systems. These too are sponsored by the Department of Labor. Except for a few well established and widely accepted programs of training, the participation of regional universities and professional societies should be sought in order to assist with development of new training programs and with definition of roles. A significant part of such efforts will be the education of professional people to accept and make use of lesser trained colleagues.

5. Special clinics and service centers of a categorical nature are frequently advocated to cope with clinical problems not adequately cared for in the usual patterns of medicine and education. This approach is seldom helpful except to the relatively few clients within the service areas of a few clinics. Categorical programs are necessary as demonstration, as research and training centers, and to provide consultations, but they seldom extend services sufficiently to meet public need. A categorical approach to health and educational services fosters a kind of tokenism of service. It also ignores the well documented observation that handicaps tend to be multiple. Much grief attends the family with a child whose problems cannot be easily labeled in a setting where labels are tickets for access to special services.

Whenever possible special health and educational services, and an admixture of the two, should be improved on behalf of *all* children in all appropriate settings. These include comprehensive neighborhood health centers, school health clinics, prepaid group medical practices, and pediatric clinics operated by health departments, community hospitals, and universities. Agencies, both educational and medical, which offer only limited services to children are obligated to screen for handicaps, and to assist with access to other agencies which provide complete services. No greater accomplishment could be achieved on behalf of children, including those with minimal brain dysfunction. Nearly all children require at one time or another some of the special services that these handicapped children require on a regular basis.

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APPENDICES

Appendix A—Neurological Evaluation

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The examination begins with observation of the general appearance, attitude, affect, and spontaneous activity of the child together with observations of his attention span, distractibility, impulsiveness, and ability to adapt to the examination and to the examiner. It is important to observe not only what tests the child accomplishes but how he accomplishes them.

A standard neurological examination is performed in which the following functions are evaluated: Cranial nerves I through XII; motor system—tone and strength; sensation-vibration, position, touch, pin; cerebellar testing; and reflexes—stretch and cutaneous.

Comments on Special Procedures

1. Inattention, distractibility, and failure of eye-head coordination can be elicited by double simultaneous stimulation of the peripheral visual field. By 5 years, the patient should be able to indicate by pointing that both the examiner's fingers are moving. Abnormal testing occurs when the patient persistently looks to either or both sides as soon as the examiner's fingers move.

2. Eye movements.

(*a*) Extraocular movements during visual pursuit of a 6-centimeter disc are smooth after 18 months of age. Horizontal jerking or saccadic extraocular movements are abnormal if persisting after this time. Visual pursuit associated with persistent head following is abnormal after 5 years of age.

(*b*) Opticokinetic nystagmus (OK nystagmus)—OK nystagmus is elicitable at any age. Normally the patient follows in the direction of motion of the moving figures with quick eye jerks occurring rhythmically in the opposite direction. The speed of the jerks varies with ability to sustain attention, and with increasing age, becomes faster. Abnormality occurs when the OK nystagmus is absent or when there is a persistent asymmetry of rate when response to movement of the targets towards one side is compared with response of movement toward the opposite side.

3. Facial apraxia: Blowing out of cheeks can be performed uniformly and alternately after 9 years of age. Facial apraxia is present if the patient is unable to perform this test over the age of 9 years.[1]

4. Hearing: Weber and Rinne tests are performed using a 1024 and air conduction is tested with a 4096 cycle per second tuning fork.

5. Pronunciation: Labials, linguals, and gutterals should be well performed by 3 to 4 years. Inability suggests a lingual apraxia.

6. Simultanagnosia: Double simultaneous stimulation testing is performed with the patient's eyes closed and stimulation with the examiner's finger four times on the following sites in variable order: Hand-hand, right hand-left face, left hand-right face. By 5 to 6 years, the normal patient makes no more than one error out of 12 stimuli.[2]

7. Performance of repetitive motions.

(*a*) Serial apposition of thumb and fingers, alternating pronation and supination of the hands, and repetitive heel-shin tapping are normally done slowly and with little or no rhythm at 3 years of age, but deliberately and with slow rhythm by 5 years of age. Abnormal performance is slow, not rhythmical and a quality to note is the persistence of avoiding response predominating over the developing flexion ability as the patient performs the test.[1]

(*b*) Clumsiness, tremor, and ataxia can be elicited in patients at 3 years by having the child place marbles in a cylinder, the diameter of which is slightly larger than the marbles. A smooth, fairly rapid performance is normal by 3 years of age.

(*c*) Synkinesiae.

(i) With finger tapping, serial apposition of fingers, and alternating supination and pronation in one hand, similar but less marked motions occur in the opposite hand up to 9 years. Such synkinesias persisting after 9 years are abnormal.[1]

(ii) Heel tapping on opposite shin associated with persistent motion of the tapped leg of variable degrees occurs normally until 8 years.[1]

8. Posture and gait.

(*a*) Posture.

(i) Resting, supine: When a child automatically assumes the infantile posture of bilateral symmetrical abduction of the shoulders, partial flexion of arms and forearms, this is abnormal after 2 years of age.

(ii) Sitting.

a. Persistent tilt of the head is abnormal at any age.

b. When asked to extend the arms and hands before them, a tendency to pronation of the arms and spooning of the fingers all exaggerated by contact stimulation of the ulnar side of the hand is abnormal over 5 years, although this activity may persist to a mild degree in the nonpreferred hand for many years.[1]

(*b*) Gait.

(i) The examiner should watch and listen to the patient's gait noting the symmetry of step, symmetry and quantity of associated movements of both arms, and listen to the sound of each foot-fall. Asymmetry suggesting minimal hemiparesis can be documented.

(ii) Toe walking: When the child walks on his toes for a minute or more, one can bring out sagging of one heel, a sign of weakness not easily elicitable otherwise in younger children. Asymmetry of arm swinging, persistent flexion of arm and forearm, or accentuated extension of arms is abnormal at any age.

(iii) Heel walking: This not only brings out weakness of dorsiflection of the foot but clumsiness and associated movements consisting of shoulder abduction, arm and forearm flection and spooning of the fingers. These postures are abnormal after 5 years, or if exaggerated are abnormal before this time.[1]

9. Visual-motor skills: The patient is asked to copy the following figures and should do so normally by the stated time.[2] [3]

Scribble—18 to 24 months of age.
Circle—24 to 36 months of age.
Cross straight line, vertical, and horizontal—3 years of age.
Square with rounded corners—3½ to 4 years of age.
Square—5 years of age.
Triangle—5 to 6 years of age.
Diamond—7 to 8 years of age.

10. Conception of spatial relationships.

(*a*) Three-dimensional square, circle, triangle (2½" x 2½" x ⅜") are placed on heavy, black-lined tracings made on three separate, standard-sized papers. The normal performance consists of the following: Stacks all figures on one paper after one demonstration, 21 to 28 months; places any form on any figure, 24 to 30 months; places forms on appropriate figures after one demonstration, 30 to 36 months.

(*b*) French curve (dimensions 3½" x 6" x ⅜") is to be placed on a heavy black-line tracing of the curve on paper. The traced outline of the curve is presented sequentially in three different positions of orientation, and after each presentation the subject is to place the curve appropriately on the outline. Normal performance consists of the following—after verbal instruction and without prior demonstration: One correct trial of three trials, 48 to 52 months; three correct trials of three trials, 54 to 60 months.[4]

11. Right-left orientation: The child can name his right and left eye, ear, hand and foot by 7 to 8 years of age.[2]

12. Auditory and visual word association and language use. Picture naming: test pictures consist of house, cup, leaf, dog, flag, star, basket, clock, shoe, and book. Normal performance: 18 months—names or points to one picture; 24 months—names three, points five; 30 months—names five, points seven; 36 months—names eight; 40 months—names 10.[3]

13. Finger agnosia.

(*a*) In-between test: With the patient's eyes closed, one touches the distal phalanges of two fingers of one hand simultaneously and asks how many fingers are in between those touched. A visual demonstration is given first and five trials are made on each hand.

(*b*) Two-point test: One touches with two fingers two points simultaneously on either one or separate fingers of one hand. Following a visual demonstration, the subject is to identify whether one or two fingers have been touched. Five trials are made on each hand. Normal standards: 50 percent of children make no errors by 5¾ years, 95 percent make no errors by age 7½ years.[6]

14. Reading ability: This may be roughly assessed by samples from the Gray Oral Reading or Gates Primary Reading Test. Reading performance one or more years below the grade placement should be referred for psychological testing.[7]

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Appendix B—Psychodiagnostics in Patients With Suspected Minimal Brain Dysfunction(s) (MBD)

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Minimal brain dysfunction (MBD) may affect the thinking or cognitive functions of the central nervous system, CNS, in a variety of ways. MBD may evenly affect all information-processing functions or "systems" of the CNS in *all* learning and communication channels to a mild or severe degree; MBD may not affect any Systems significantly at all; or MBD may affect various Systems and Channels differentially as reflected in the well-known phenomenon of variability of psychological tests batteries. Table 1 shows 14 commonly affected information-processing systems, $S^{1 \cdots 14}$ listed in a "prerequisite skill" order in which these Systems emerge in normal ontogeny (*1*). Table 2 shows 24 commonly affected Channels within which these Systems operate on information to yield the thinking or cognitive skills or processes.

To be clinically useful a diagnostic examination must be sensitive and specific to the major System disorders of communication, learning, memory, localization, and perception (table 1) which are so prevalent in persons with suspected MBD, such as congenitally handicapped children or adult stroke patients. These major disorders or "Organic Learning Disabilities," OLD, include the acalculias, dyslexias, aphasias, concept formation disorders, conditioning disorders such as agnosias and apraxias, as well as the disorders of resolution, discrimination, and articulation, and the disorders of localization, arousal, and habituation. To achieve sufficient sensitivity and specificity so that diagnostic OLD examinations and the profiles of interacting System dysfunctions they yield can be translated into treatment and teaching strategies, a disorder profile must have adequate resolution. Specifically, the profile must be of sufficiently high resolution to display the Critical Values, V's, or specifications to which skills prerequisite to the dysfunctioning System must perform to permit the normal emergence of the next highest skill or System in a learning or communication Channel.

To achieve such sensitivity, specificity, or resolution requires that the major disorders be subclassified along a number of factors or dimensions such as: (1) The learning and communication Channel(s) or the input-output modality to which the disorders are specific; (2) the *subtractive* versus *additive* dimension where the term subtractive is used in the sense of a System not generating a required function, while additive is used in the sense of a System generating noise into various learning and communication Channels; (3) the Critical Value of Disorder-Severity, as measured functionally by primary-secondary disorder relationships; and (4) the Disorder Modifiability Characteristics such as permanence and rate of modifiability, the conditional remission probability of secondary disorders, etc.

The search for disorders.—In view of the fact that Organic Learning Disabilities may affect some or all of the person's activities of daily living, their existence is likely to be reflected in a distribution of test scores designed to sample these activities. The generic test scales, table 3, column 3, found on Formal Test Batteries, FTB, such as Binet, WISC, Academic Achievement Tests, etc., are designed to sample such activities; they measure primarily past learning rates and current achievement levels. A distribution of standard scores or IQ equivalent scores, IQE, obtained from FTB scales and recorded in table 3, column 4, then may be conceptualized as representing a distribution of current mental and cognitive abilities. Thus, in patients with suspected brain dysfunction or suspected environmental deprivation of learning opportunities, such a distribution of skills or IQE scores can be expected to contain embedded within it one or more types or subtypes of the noted "Organic Learning Disabilities" which give rise to increased distribution variance. A diagnostician, then, must search for stable data patterns within the distribution to guide him in finding the Channel and System containing the primary dysfunction(s) in prerequisite skills giving rise to secondary dysfunctions.

FTB's inadequate for diagnosis.—Standard test administration and standard data analysis as prescribed in the manuals of the FTB's cannot reveal the differential effect of brain dysfunctions on these learning and communication Systems in the various Channels because neither the required test administration nor the required data analysis are Channel- and System-specific. For example, so-called language tests are commonly administered with major pantomime language instructions. As a result, many young children or adult stroke patients with major central language disorders such as the agnosias or aphasias, but otherwise adequate intelligence, are often erroneously credited with understanding spoken language—an error resulting from Channel confusion. Similarly, many adults are often credited with the capability to recombine word concepts into true psycholinguistic constructs or sentences when in fact they have only the ability to activate rote, rigid, indivisible speech programs which are linguistic sentences, but the elements of which cannot be recombined into innovative psycholinguistic constructs. This is an error resulting from System confusion—confusing System S^6 with S^{11}, table 1. Therefore, in suspect distributions all test items must ultimately be classified by the Systems essential for success and the Channel where success is expected, as in table 3, column 2.

Limit-testing required.—The fact that a child or adult patient uses automatic speech phrases, cliches, or parroted sentences does not at all preclude the possibility that he may use different concepts and language units correctly to construct true or innovative psycholinguistic sentences. The ultimate purpose of diagnosis, of course, is to improve predictions on the success to be encountered in teaching the patient to solve all types of *new* problems as these arise in his activities of daily living. The administration of FTB's alone will not yield the best predictors because (*a*) rote memory or built-in reflexive programs may simulate innovative information-processing successes on many FTB test items in all FTB subscales, and (*b*) FTB testing restrictions on time, testing conditions, etc., often require assigning failure scores to suboptimal though useful skills. Vastly improved predictors of a patient's potential for new learning will be found on examinations which test the patient's *limits* in current *new-learning* capabilities. A diagnostic examination for OLD, then, must always include *limit-testing,* or the setting up of an experimental analog of a Channel-specific learning and communication process to determine the status of all expected information-processing Systems (table 1) in all expected learning and communication Channels (table 2). Basically, limit-testing establishes how far up the ranked list of prelinguistic and linguistic Systems in all Channels the patient can be taught to achieve (or will spontaneously achieve) success when he is given optimal opportunities for acquiring the prerequisite skills.

Problems with Channel- and System-specific limit-testing.—A frequent objection to the pursuit of such differential diagnosis is that there are no "norms" for limit-testing—that is, no norms for when an expected System or class within a Channel should first be experimentally demonstrable (the System's "First Emergence Age," FEA). While such FEA norms would be useful, they are not necessary. Empirically, diagnostic limit-testing with over 4,000 child and adult patients reveals that when a skill-class or System is totally absent in a patient (an empty class with no successful members) at an age when FTB's include member items on their scales, that System is invariably significantly past due. Intuitively, it stands to reason that an examiner should be able to force, or make demonstrable, an existing skill before that skill becomes so visible as to be expected in the normative population. Thus, FTB's do in fact provide diagnosticians with norms for when Systems are past due—past-due-age (PDA) norms in which the diagnostician can have specifiable confidence.

Illustration.—An example illustrates how normative data must be used as PDA norms in diagnostic limit-testing to estimate Channel-specific Systems-emergence rates or learning rates in adults as well as in infants. At the 9-month level on most developmental batteries an infant is expected to pass an "Adjust-to-Gesture" test and an "Adjust-to-Word" test. The formal instructions in the manuals do not specify the need for audio Channel-specific test administration, nor the need for avoiding Channel contaminations by gestures, sound, contextual cues, etc. In fact, parental reporting of successes with adjusting to words or gestures can be credited (*2*). For purposes of differential diagnosis with children or adults in whom we expect MBD for any reason whatever, we must present both the pantomime and spoken language tests in mutually exclusive input channels, if the stroke patient or child only fails the spoken word test but passes the gesture language test, we raise our suspicion of "faulty audio Channel-specific intelligence."

To estimate the past and future audio Channel- and System-specific language-emergence rate, we must then create an experimental analog of a Channel-specific "first-language" learning and communication process. The experimental paradigm must attempt to teach the adult or child patient to adjust to a word. Channel-specific test items found on the formal tests can be used to limit-test or teach the prerequisite skills. Thus, teaching the new word involves activating a sound awareness System; it involves testing for a habituation System; it involves activating localization, discrimination, resolution, and conditioning Systems, etc.—in fact, all the starred "Systems" of table 1. One or more specific test items which sample each of these Systems can be found on all the better known test batteries. Thus, FTB's provide the needed empirically determined age norms. If the brain functions or Systems in the patient indeed are operational, as expected in the normal 9-month-old, then these Systems should also be demonstrable by an examiner "intent" on demonstrating them individually during limit-testing. We find, in fact, that the stroke patient or 9-month-old infant who has truly learned to adjust to words, "outside of the office" can *invariably* be taught in a short teaching session to adjust to new words in an office procedure. Empirically, we find that a normal 6-month-old can already be taught to adjust to words in a 20-minute office procedure. Such a finding illustrates the empirical fact that item-specific age norms as "reported" on formal test batteries by their location on Guttman scales, always exceed significantly the empirically found age at which a System is first minimally demonstrable experimentally.

This fact can be exploited for differential diagnosis even at the 9-month level, and certainly with stroke patients. For example, we can state categorically that when the 9-month-old infant or stroke patient is readily taught to make new responses in a gesture language (to control for minimally adequate "global intelligence") but *cannot* be taught to make new responses to spoken words, then this finding is invariably pathognomonic of auditory Channel-specific dysfuntion(s). To generalize, when a System has totally failed to emerge, as revealed by limit-testing, by the time developmental tests expect test item-specific successes, this finding is invariably pathognomonic. While a diagnosis could be made earlier for those Systems where limit-tested FEA norms are available, there is often no great premium for reducing the age of first diagnosis by a few weeks or months. The later diagnosis based on "standard norms" reduces the probability of making a false-positive identification. In the illustration cited, we estimate our probability of making a false-positive identification of audio Channel-specific dysfunction in infants or adults to be less than 1 in 1,000.

Pitfalls in using norms to make predictions.—Common data patterns in a stroke patient or 2-year-old illustrate the pitfalls in using norms and IQE scores as well as the proper use of such norms in diagnostic Channel- and System-specific limit-testing. Assume that a stroke patient or 2-year-old fails to adjust to the meaning of words (for example, when he has an auditory agnosia or intermodal conditioning dysfunction at S^7). Such a patient may demonstrate good visual pantomime language skills (to control for adequate global intelligence) and may parrot words or phrases beautifully. These latter skills earn him "normal" IQE scores of 100 or better for audio speech discrimination and resolution Systems, S^4 and S^5, table 1, and expressive speech articulation Systems, S^6. In such a case we do not use the 100 IQE achieved on prerequisite skill Systems as a predictor. We will mention that score as a "splinter skill," but predict future learning along the language-learning dimension entirely on the basis of the "way-past-due" conditioning System, S^7. In this particular case, we predict the conditional emergence of language skills only upon the remission of the agnosia. Specifically, in the stroke patient or child *who parrots well,* we predict no success whatever with attempts at teaching sound recognition or language skills in that Channel, for no one has ever "cured" by teaching (*3*) such an agnosia or aphasia where prerequisite skills exceed Critical Values. We predict remission entirely on the basis of known spontaneous remission rates for the pathologic condition of agnosia or aphasia, etc.

To generalize, in order to predict a future Systems-emergence rate along the language-learning dimension (table 1) in any one Channel, we first convert all limit-tested success and failure patterns into System-specific IQE scores using the published "standard norms." If all expected Systems are at least minimally present, then we use only the IQE value of the most difficult item passed within the highest System as a predictor for the emergence rate of future Systems or language-learning capabilities in that Channel. However, when all expected Systems are *not* minimally present in a Channel, then the maximum IQE score in that Channel must never exceed the Mental Age or IQE value of the FEA of the defective System; in essence, in such cases we make separate Channel- and System-specific predictions from Boolean matrices to be described.

Formal systems analysis required.—The relatively simple illustrations may make the more formal quantitative reasoning process described appear unnecessary. However, the *large* number of possible Organic Learning Disabilities which may give rise to persistent failures on the "Adjust-to-Words" or "Adjust-to-Gestures" tests at the 9-month level alone is sufficient to justify a more formal approach to avoid Channel and System confusions. The starred Channels of table 2 are frequently affected learning and communication Channels giving rise to failures at this level. In table 2, note the separate listing of modality-specific Channels and sub-Channels corresponding to the various pantomime, spoken, recorded, and mathematical language sub-Channels through which learning and communication take place—that is, within which the CNS–mediated transformational Systems are activated and solutions are constructed.

The starred items of table 1 constitute an *ordered* list of frequently affected capabilities or Systems giving rise to failure on these 9-month-level tasks. Combining the starred items of tables 1 and 2 as potential Channel-specific, System-specific disorders yields a list of 11 × 12 or 132 potential Organic Learning Disabilities such as the auditory agnosias, verbal apraxias, visual agnosias, fine-motor apraxias, etc., each of which may give rise to failure. Each of these may be amenable to teaching intervention, or each may be as refractory to teaching as the "well-parroting" agnosia case cited. The differential diagnosis must be pursued minimally to a level of fineness which permits us to distinguish teaching intervention and those which are not.

High articulation field.—A rapid systematic and comprehensive search for potential Organic Learning Disabilities is made feasible by the empirical fact that the prerequisite skill orders shown in table 1 are inviolable when the skills are arranged in Channel-specific scales. First, note that the generic labels in table 1 can be applied to all learning and communication Channels as well as the individual input and output modalities. Not only is the rank order shown inviolable within any Channel in phylogeny and ontogeny, but in ontogeny the rank order is inviolable both in new learning as as well as in relearning processes (as in stroke patients). Here it is important to point out as others have done (4–7) that all true psycholinguistic processes require innovative problem solving—that is, *new learning* while a dialog takes place. Thus, any totally absent System or severely malfunctioning System must therefore be associated with, or give rise to total or characteristic psycholinguistic failures beyond that level in the hierarchy.

Functional brain maps or data matrices.—The inviolable order found in nature suggests a "prerequisite skill" information-flow model. In this model the capabilities, Systems, or potential disorders can be represented as an exploded block diagram of prerequisite Systems as in fig. 1. Here, assume that S^i is System No. 10, a concept comprehension System; S^{i+1} is System No. 11, sentence comprehension; and S^{i+2} is System No. 12, messages or sentence-string comprehension. The diagonal shows a standard-type block diagram where an informational *output* product (which also makes S^i minimally demonstrable by independent tests during experimental limit-testing) may serve as an *input* into S^{i+1} along the diagonal for further reuse.

The boxes in columns below each S_1^i represent increments above minimal System specifications—$S_1^i{}_{\ldots n}$. These increments may be required in order to deliver a more specialized product further up the chain of Systems ($S^{i+2 \ldots 14}$). Thus, to understand sentence strings or messages (S^{i+2}), a person must not only have demonstrable capability in understanding some words as concepts, S_1^i, but must understand a number of words from different concept classes (nouns, verbs, adjectives) S_2^i, in order to make concept integration or sentence comprehension (S_1^{i+1}) conceivable. Thus, the 14th System may require 104 sub-Systems to operate to critical specifications. For example, an auditory discrimination System, S_1^4, must function not only to minimal specifications to make discrimination experimentally demonstrable, but must function to higher specifications to permit resolution of words, S_2^4. The discrimination System must function to even higher specifications to permit verbal conditioning, S_8^4, and to even higher specifications to permit verbal conditioning at a rate sufficient to allow a spoken dialog to take place in which two persons generate new concepts and psycholinguistic structures, S_{12}^4.

Types of breaks or lesions.—When an information-flow break or lesion is found in one of the prerequisite sub-Systems, that sub-System may be in any one of a number of lesion end-states. For example, a faulty concept formation System may be entirely unmodifiable so that vocabulary building or exchange is impossible. Or it may be modifiable but at a slow rate; or, the concept formation System may be transiently but not permanently modifiable; or, the permanent storage capacity for concepts may be below the critical level required for rapid concept retrieval and reuse during spoken dialogs or during reading comprehension.

In addition to such subtractive losses, persons with MBD frequently manifest "additive losses" where a malfunctioning System generates noise into other information-handling Systems and Channels. For example, children with severe speech clutter, or stroke patients with involuntary speech insertions may generate so much noise into their own auditory Channels as to interfere with language comprehension during ordinary dialog.

We find that in patients with suspected MBD a minimally adequate clinical examination must search for at least 17 common lesion end-states for each of the sub-Systems. Therefore, in our abridged list of Channels and Systems, a diagnostic examination utilizing systems analysis techniques must cover at leat 17 × 104 sub-Systems in each of the 24 Channels yielding a total of 42,432 interrelated sub-sub-Systems or data points.

Feasibility.—To cover such a large number of data points, we again exploit the hierarchical structure of our ordered set of Systems (table 1) by utilizing efficient testing paths or sequences. These always start in that Channel which requires the largest number of operational modalities or Channel combinations; we always start with the most complex System in that test Channel. When success is found, this permits us to credit in binary fashion minimal successes into all prerequisite subskill and sub-subskill boxes. When failure is found, we go "down the tree" to the second most complex System etc., and later to the second most complex test Channel combination. In this way we use the exploded block diagram as a Boolean Data Matrix. The data patterns entered into such Boolean Data Matrices are readily interpreted by professionals, technicians, and/or computers, and converted automatically into Channel-specific, System-specific diagnostic profiles which can be further translated by man or computers into clinical report formats.

High-resolution profiles describing interacting capability and disability patterns have immediate implications for the selections of treatment and educational strategies. For example, in a Reading Channel, the Systems shown in fig. 1 may contain entries indicating that a patient's (*a*) single word vocabulary, $S^{i=10}$, or single sentence comprehension capabilities, $S^{i=11}$, *exceed by far* the minimal critical requirements for the comprehension of sentence strings or messages ($S^{10}_{n=3}$ or $S^{11}_{n=2}$) but (*b*) the patient has no written or printed message comprehension. In such a case of "dyslexia," we would consider the capabilities in (*a*) to be splinter skills; we would not continue to emphasize vocabulary building as the treatment of choice for overcoming the reading disability. In contrast, when we find that a patient fails to understand more complex messages because he does not have an adequate single word vocabulary, $S^{10}_{n=2}$, then vocabulary building is the treatment of choice. Thus, the location of the disability or lesion in the map or Boolean Matrix with respect to critical sub-System values (and the modifiability probability) must determine the treatment selection.

In view of the high confusion probabilities between and among Channels, Systems, and sub-Systems, and the probability of wrong identification of sub-System functions with respect to a Critical Value, we favor a *formal* systems analysis approach to diagnosis and treatment selection. At Hopkins we have trained technicians using special-purpose digital paper-and-pencil computers to guide them through data determined flexible diagnostic paths in the search for (*a*) approximately 200,000 Organic Learning Disabilities, (2) Channel-specific estimates of intelligence, as well as (*c*) a single value estimate of more global potential intelligence or Intra-Patient Standard.

The technicians begin by administering standard tests in standard fashion as required by the manuals. They will deviate from standard testing procedures *only* when their suspicions have been aroused by at least one "significantly deviant score" suggesting the possibility that learning rates may be "nonnormal." Each test score is recorded on a Continuous Testing Record (not shown) to determine whether it differs significantly by some "cutting value" from population norms, subculture and family norms, or "Intra-Patient Standard" norms. A single significant deviation will cause technicians to move from standard psychologic testing to Channel-specific, System-specific limit-testing techniques. Recording limit-tested score distributions in a separate column (as in table 3, column 5), partially reduces variability due to correctable, peripheral sensory-motor factors, experience (exposure and practice) discipline and similar cultural factors. Difference scores between limit-tested learning profiles and standard test score profiles then reveal how much a person learned under specified sets of learning opportunities provided during an examination. The difference scores also reveal whether or not an asymptote was reached during a single session. If *none* is reached, as is sometimes the case in "cultural deprivation," enrichment programs are indicated.

Without such limit-testing and such systems analysis techniques we can conceive of no method for distinguishing among failures due to (*a*) experiential or psychosocial factors, (*b*) correctable sensory-motor factors (speaking louder or steadying a hand), (*c*) transient volitional, cooperational, attentional, or random factors such as luck, (*d*) organic Channel- and System-specific limitations including the nonvolitional components of distractability, cooperation, and attention, (*e*) the less common Channel confusions such as assigning success to auditory associations when they should be assigned to kinesthetic speech memory associations, and (*f*) the common System confusions such as crediting the patient with psycholinguistic sentence construction capabilities when, in fact, he can only generate rote speech programs which sound like sentences.

We find that such systematic and comprehensive searches for Organic Learning Disabilities by technicians save professional time and money. The total examination takes on the average of 2½ to 3 hours per patient and costs on the average of approximately $100, which includes quality control checks, electronic data processing, electronic recordkeeping and retrieval, and professional counseling.

State of the art.—While we favor a formal systems analysis approach, there have always been diagnosticians who manage to do a careful informal systems analysis. At the present time, these "good diagnosticians" are not found exclusively in any one discipline. They may be neurology, psychology, or education; many diagnosticians are "good" in only specialized subbranches of the Organic Learning Disability field—for example, they may be good in the audiologic sensory-motor branch of the hearing and speech tree, but commit serious errors in the psycholinguistic branches of that tree, or in other Channels, or in estimates of potential intelligence. At present, no discipline formally teaches diagnostic searches or systems analysis techniques. No discipline has standards for a minimally adequate examination for minimal cerebral dysfunction or Organic Learning Disabilities. Obviously, to improve the level of service to patients with minimal cerebral dysfunction and Organic Learning Disabilities, the shortcomings in professional training and professional examination standards must be overcome.

In the meantime, how can a referring pediatrician, neurologist, psychologist, or family member determine whether a diagnostic examination performed on a patient was subjected to a reasonable formal or informal systems analysis? That is, how can one tell whether a diagnostic reasoning process was applied or whether only a standard normative examination aimed at estimating global intelligence was attempted and given?

Two criteria are easily applied. First, a diagnostic center is readily judged by the number of untestable patients it reports. When limit-testing procedures are applied, we find in a population of approximately 4,000 difficult-to-test children and adults, that the number of patients for whom we cannot make a reasonable diagnosis in one day is less than 1 in 1,000. Therefore, any center which reports more than 5-percent failures of arriving at useful diagnostic profiles would be suspect to us.

Second, there is no way of performing a systems analysis for Organic Learning Disabilities unless exquisite care is taken against possible Channel and System contaminations. System contaminations are difficult to judge for all but the sophisticated. (Even for the sophisticated, formal testing paths are frequently required to distinguish between rote speech automatisms versus true psycholinguistic constructs.) However, it is easy to determine whether efforts were made to perform Channel-specific limit-testing. Therefore, any examiner who cannot provide evidence of guarding aginst such confusions as auditory successes versus pantomime visual or kinesthetic speech success, etc., or confusion of receptor versus effector failures, could not possibly arrive at a diagnosis which warrants confidence.

In brief, failure to test the limits and failure to follow Channel-specific test administration precludes the possibility of any kind of systems analysis, which in turn precludes the possibility of (*a*) guarding against avoidable errors in diagnostic profiles, and (*b*) selecting optimal diagnosis-specific treatment and educational strategies.

Clearly, the time to search for Organic Learning Disabilities systematically and comprehensively is before years of avoidable erroneous expectations and avoidable failure to distinguish between indicated versus counterindicated treatment efforts have conditioned the patient and his family to expect failure in all teaching efforts. Many Organic Learning Disabilities, for example, the milder dyslexias, cannot now be detected until the expected ability is significantly "past due" on academic schedules or until a necessary prerequisite skill has failed to emerge. According to the "2-year-behind" criterion (*8*) or definition for dyslexia, one does not now ordinarily diagnose a dyslexia earlier than about age 8. In this particular disability, norms on the "past due age" of experimental learning-to-read paradigms may well lead to the early detection of dyslexias—perhaps by age 5—and the prevention of secondary psychiatric and behavior problems. Clearly, the initiation of early prevention or remedial teaching efforts requires careful monitoring of the emergence of intellectual or cognitive abilities in all Channels through which learning takes place. In many high-risk patients, two or more neuropsychologic diagnostic examinations for Organic Learning

Disabilities may be required in the preschool years with regular followups during the school years.

To summarize, minimal cerebral dysfunction may give rise to a vast number of minimally-to-severely incapacitating Organic Learning Disabilities affecting specific information-handling Systems in specific learning and communication Channels. The Organic Learning Disabilities may be almost entirely unpredictable on the basis of neurologic-type data alone. However, the disabilities exist in a very high articulation field. This allows making predictions about an enormous number of capabilities on the basis of information on a small number of primary disabilities. To find these primary disabilities requires Channel- and System-specific diagnostic limit-testing and a formal systems analysis of the data.

It is much easier to train technicians or professionals to follow efficient, formal, systematic and comprehensive testing paths and systems analysis procedures than it is to teach them to cover the same field with informal diagnostic examinations. Our experience suggests that it is possible to train psychodiagnostic technicians recruited from a college-caliber population in 3 months; furthermore, it is possible to train master technicians capable of training new generations of diagnostic technicians within a 9-month period. It goes without saying that only the use of *formal* systematic and comprehensive diagnostics permits us to control the quality of the technician-administered examinations and reports. Furthermore, only formal systematic and comprehensive techniques permit us to exploit currently available computer technology for followup studies and large-scale field and epidemiologic studies. It is for these reasons that we recommend that a number of leading university centers be encouraged to develop formal master decision trees to further the state of the art.

When the term education is used generically to include special education, vocational, and physical rehabilitation, as well as the behavior-shaping efforts of psychotherapy, then the money spent on the education of persons with minimal or major dysfunction of the central nervous system is undoubtedly a large part of the total health and education effort. Yet, a recent search of the literature reveals that no data are currently available on the natural history of Learning Disability profiles in children or adults, so that at present there are no ways of parceling out the effect of medical treatment or teaching efforts versus spontaneous remissions in various suspect populations. We see no way of reducing the gap between scientific knowhow and delivery of health services in this area of the mental health field without requiring high-resolution differential diagnoses of Organic Learning Disabilities as a routine part of the baseline intake process of the suspect patient. Without such baselines and diagnostic followup profiles to monitor the patient's progress, there is no way of assessing the cost-benefit to the Nation of these vast expenditures.

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TABLE 1.—*Abridged, ordered list of 14 information-processing functions performed by the Central Nervous System within the various Channels in which learning takes place. Each function becomes readily demonstrable as a capability or "System" within the Channel-modalities shown in column 4 at the chronological age shown in column 3. Each System is therefore a potential Organic Learning Disability corresponding to the major signal detection, localization, discrimination, and resolution disorders, the feedback loop disorders and the agnosias, apraxias, concept formation disorders, aphasias, acalculias, and dyslexias prevalent in persons with suspected minimal cerebral dysfunction*

(1)	(2)	(3)	(4)
* 1	Arousal threshold changes	Birth	Audio
* 2	Habituation-vigilance	Birth	A
* 3	Learned (L) localization	2 Mos.	Visual
* 4	L. Between contour discrimination	2½	A
* 5	L. Within contour resolution	3 (—)	V
* 6	L. Input-output feedback monitoring	3½	V
* 7	Between input channel conditioning	4½	AV
* 8	Between and within channel conditioning	7 (—)	A
* 9	Directed secondary signal sending	8	AV
* 10	Concept formation	14 (est)	AV
* 11	3-Unit concept integration or sentence creation	36 (—)	AV
12	2-Sentence message creation	54 (—)	AV
13	Mathematical word problem solving	72 (—, —)	AV
14	Use of recorded language(s)	72 (—)	AV

TABLE 2.—*An abridged list of 24 communication, learning or "teaching-testing" channels*

	COMMON TEST CHANNELS USED IN DIAGNOSTIC TESTING		
* 1	Audio (Aud)	→	Gross Motor (G)
* 2	Aud	→	Fine Motor (F)
* 3	Aud	→	Speech Motor (S)
* 4	Aud—Spoken Language (SPL)	→	G
* 5	Aud—SPL	→	F
* 6	Aud—SPL	→	S
7	Aud—SPL Math	→	G
8	Aud—SPL Math	→	F
9	Aud—SPL Math	→	S
* 10	Visual (Vis)	→	G
* 11	Vis	→	F
* 12	Vis	→	S
* 13	Vis Pantomime Language (PL)	→	G
* 14	Vis PL	→	F
* 15	Vis PL	→	S
16	Vis Recorded Language (reading & writing, R&W)	→	G
17	Vis R&W	→	F
18	Vis R&W	→	S
19	Vis R&W and Math	→	G
20	Vis R&W and Math	→	F
21	Vis R&W and Math	→	S
	COMMON TEST CHANNEL COMBINATIONS USED IN FORMAL TEST BATTERIES		
22	Aud—SPL+Vis PL	→	G
23	Aud—SPL+Vis PL	→	F
24	Aud—SPL+Vis PL	→	S

TABLE 3.—*Segment of a decision tree or data matrix in clinical use at Hopkins during the early screening phases of a diagnostic examination. For purposes of this presentation the forms in actual use were modified here to highlight some key features of the diagnostic process. Thus, IQE scores obtained on commonly used test scales, column 3, can be entered as these were obtained under standard testing conditions in column 4, and as these scores were obtained under limit-tested (optimized) conditions in column 5. All column 5 scores must be obtained under Channel-specific, and System, sub-System, or factor-specific testing conditions, and column 2 suggests how major scales are classified according to Channel (C) and Systems (S). Column 1 as well as the M-memory notation next to some of the scales in column 3 are designed to show that scales belong to special "dimensions" or "factor classes." Columns 6 and 7 show that a within and between class cluster analysis of scores determines how well preselected factors account for the distribution variance. Numerous other factor-matrices not shown are embedded within the matrix, and are serially superimposed upon this matrix during data analysis aimed at accounting for column 5 distribution variance. Binary profile columns 8 to 13 are designed to show that a Channel-specific "sequence-processing factor" embedded within the eight ability classes in column 1 (unexplained in this manuscript) may be associated with 28 or 256 mental variability profiles (MVP) showing major areas and subareas of cognitive strength and weakness; these profiles then determine subsequent profile-specific search patterns for primary dysfunctions within the detected areas and subareas of weakness*

Ability class	Channel No.: C= System: S ≥	Tests (generic scales)	IQE		Class IQE		Binary profiles	
			Std.	Opt.	Min.	Max.	1st	6th
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(13)
1	C=1 . . . 24 S≥1	A. Social inventory B. Controlled tasks						
2	C=14 S≥11	A. Blocks B. Form discrimination C. Object assembly D. Stencil design						
4	C=14 S≥11	A. Figure memory (M) B. Paper fold C. Sequence memory (M)						
8	C=6 S≥11	A. Digits forward (M) B. Sentences (M) C. Vocabulary D. Oral information						
16	C=6 S≥11	A. Digits reversed (M) B. Retells story (M) C. Comprehension D. Abstract reasoning						
32	C=9 S≥13	A. Oral arithmetic						
64	C=17, 18, 20 S≥11, 12, 13, 14	A. Reading 1. Single words 2. Phrases 3. Paragraphs 4. Stories B. Written information C. Arithmetic 1. Computation (+ − × ÷) 2. Word problems						
128	C=24 S≥14	A. Spontaneous memo making						
							MVP No:	MVP No:

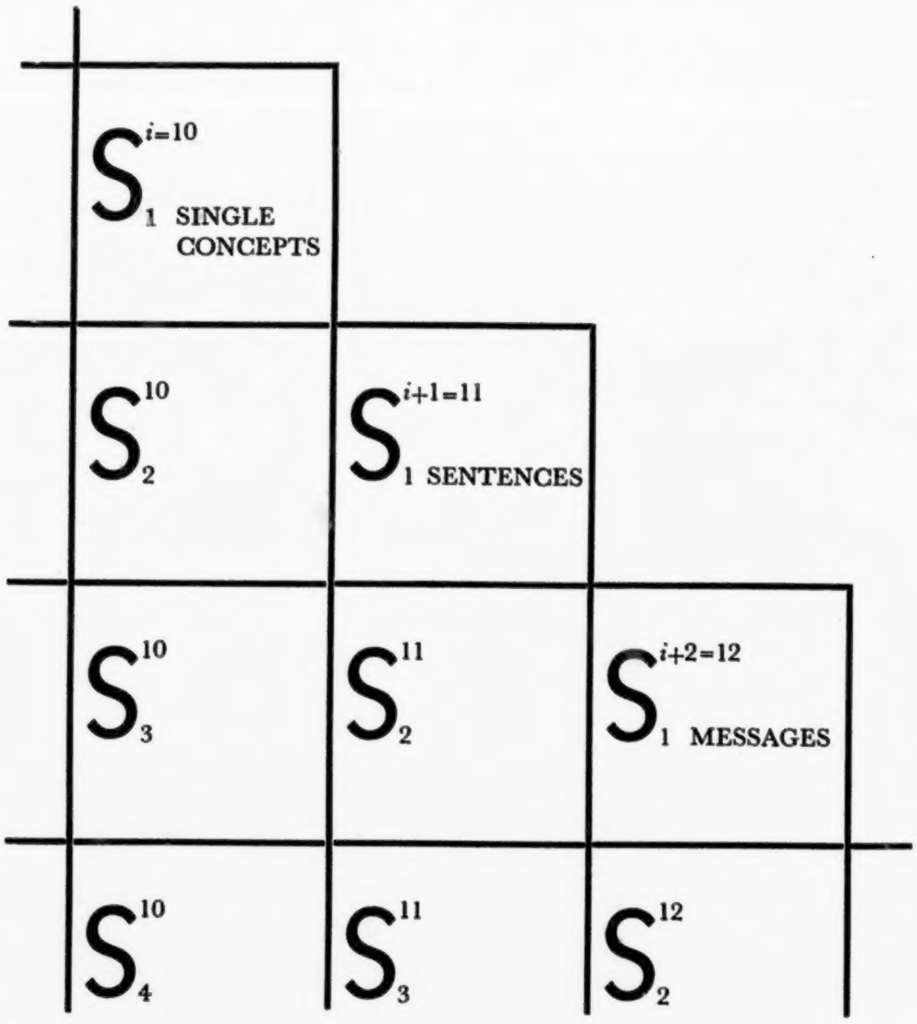
$S_1^{i=10}$ SINGLE CONCEPTS
S_2^{10}
$S_1^{i+1=11}$ SENTENCES
S_3^{10}
S_2^{11}
$S_1^{i+2=12}$ MESSAGES
S_4^{10}
S_3^{11}
S_2^{12}

FIGURE 1. A partially exploded block diagram representing a 3-system segment of the hierarchy of 14 information-processing Systems of table 1.

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